1888

Elephantoid Disease.

by

J. Maitland. M.B.

INTRODUCTION.

Our knowledge regarding the nature and causes of elephantoid diseases has, of late years, been so enlightened by the important discoveries made by Manson, Lewis, and others, as to remove, to a great extent, the obscurity which formerly shrouded the origin and pathology of these disorders. Some of the views of Manson however have not received universal acceptation; and to many who have had no practical acquaintanceship with the disease, there still remain some points of difficulty and doubt. These doubts are, I believe, in a great measure due to inaccurate information; resulting from the absence of any systematic attempt to review the nature of the discoveries that have been made, to clear up the doubtful points, and so to piece together the various items of our knowledge, as to establish a definite and intelligible picture of the disease. Having an acquaintanceship with the disease extending over a good many years, and having, within the past five years especially, met with and treated many cases of elephantiasis, in the General Hospital of Madras, I have been led to study the subject with special interest; and have been induced to attempt such

a description of it, as I have indicated above. There are so many points in regard to elephantoid disease, which at first sight appear quite inexplicable, that there is little wonder that there is so much confusion on the subject, in the minds of those who have had no practical acquaintanceship with the disease; and so much incredulity regarding the more recent explanations of its pathology. These difficulties can only be overcome by a practical study, not only of the separate varieties of the disease, but more especially of those transitional forms, which serve to show the unity of the disease.

It is my particular purpose, in the following pages, to demonstrate the unity and pathological identity of elephantoid diseases; and at the same time to point out the causes that determine, which of the two varieties of the disease will, in a particular case, be ultimately established.

Another reason which has induced me to take up the subject of elephantoid disease, is the necessity of pointing out the unjustifiability of ligaturing the main artery, in cases of elephantiasis of the limbs. It may seem a work of supererogation to condemn an operation, which has not only received the disapprobation of many eminent surgeons in this country, but has also been long since abandoned by all

those who have had much experience in the treatment of the disease. But the fact that the operation is still treated of in some text books as a legitimate one, and is still from time to time practised, not only in this country, but in other parts of the world, show that the unjustifiability of the operation is not as widely recognised as it should be.

I have also introduced some remarks on the operation for removal of elephantoid or lymph-scrotum, for although, in the main, I adopt the method in general use in India, yet I have been induced to make certain modifications in the operation, with the view of expediting the healing process. Moreover, as there are some surgeons who still, in operating, retain flaps of skin to cover the testicles; it is necessary to insist most strongly upon the impropriety of such attempts.

SYNONYMS.

Elephantiasis is known by a great variety of names, such as:- (1) Bucnœmia tropica, Morbus Elephas, Elephantiasis Indica, Spargosis, Hernia Carnosa, Phlegmesia Malabarica, Egyptian Sarcocele, Barbadoes leg, Glandular disease of Barbadoes, Yam leg, Cochin leg, Galle leg, and Toa-kha-tung (China). In India, it is known by a great variety of names; all of which

(1) "Tropical dysentery." p.258. Fayrer.

signify the term "elephant's foot." Almost all these designations have reference to the most manifest symptom of the disease, that is to say,, to the thickening of the legs. One of them alone, namely "Glandular disease of Barbadoes", refers to an affection of the lymphatic system. (1) "Varix lymphaticus" or "lymphatic varix" is known also as "Naevoid Elephantiasis", or "Lymphangiectodes." When it affects the scrotum, the disease is termed "Lymphscrotum."

Although the terms elephantiasis and lymphatic varix are convenient, as indicating the characteristic appearance of these particular varieties of the disease; yet it must be borne in mind, that both of these affections, as well as chyluria, are the result of one and the same cause; namely of lesions of the lymphatic system produced by the parasite, "Filaria Sanguinis Hominis." Hence these diseases collectively, are termed "Filarial disease."

DEFINITION.

Elephantiasis may be defined as a disease which is endemic in certain localities; which is characterised by progressive hypertrophy of the subdermic connective tissue, usually of the limbs or genital organs; and which is the result of obstruction of the lymphatic chan-

---

(1) Transactions of the Medical & Physical Society, Bombay. 1861. H.V. Carter.

nels which drain the affected area; the obstruction being the result of plugging of these channels by the ova of the "Filaria Sanguinis Hominis."

Lymphatic varix is a disease which manifests itself by dilatation and varicosity of the lymph channels of some part of the body, and is the result of causes similar to those which produce elephantiasis.

The difference between the two diseases lies in the fact that in elephantiasis the damage to the lymphatics is so complete as to produce stagnation and subsequent organisation of lymph; whereas in lymphatic varix the obstruction of the lymphatics is only partial, and the lymph continues to flow, although at a diminished rate, and accompanied by increased tension of the vessels. This increased tension results, from time to time, in rupture of the vessels, and in discharge of lymph from the surface, either of the skin, or of a mucous or serous surface. When discharge takes place from the skin, it constitutes what is termed "lymphorrhagia" or "lymphorrhoea;" when the lymph is discharged into the urinary tract chyluria results, and when into the abdominal cavity we have chylous ascites.

Elephantiasis is the expression of lesions which result in stagnation of lymph; lymphatic varix is the expression of lesions which impede the flow of lymph,

and cause increased tension of the absorbents.

Elephantiasis implies stagnation of lymph, lymphatic varix implies increased tension of the absorbents; the former results in progressive hypertrophy of the subcutaneous tissue, the latter in dilatation and varicosity of the lymphatics; the former terminates in deformity and giant growth, the latter may give rise to exhausting discharges of lymph; both induce susceptibility to attacks of local inflammation and constitutional disturbance.

ETIOLOGY.

Up to a comparatively recent period nothing was known regarding the causes of this disease. (1) Goodeve, (2) Waring, and (3) others ascribed it to malaria; whilst (4) Wise thought it due to phlebitis. (5) Allan Webb recognised two varieties of the disease, one of which he ascribed to malaria, the other to syphilis and tubercle. Other surgeons considered it due to exposure to extreme degrees of heat and moisture. The first step in the discovery of its parasitic nature

---

(1) Transactions of the Calcutta Medical and Physical Society. vol.VII. p.9
(2) Indian Annals of Medical Science, vol.V. p.1.
(3) On certain endemic skin and other diseases &c. Tilbury Fox & Farquhar.
(4) Transactions of the Calcutta Med. & Phys. Soc. vol. VII, p.156.
(5) Indian Annals of Medical Science, vol.VII, p.619.

was made in 1866 by Wucherer, who discovered the embryo filariae in the urine. Similar discoveries were made, in 1868 by Salisbury, and in 1869 by (1)Lewis. The latter observer was the first to recognise the true nature of the embryo parasite. In 1871 further discoveries of the embryo in the urine were made by Silva Lima and Crevaux. In 1872 (2)Lewis discovered the embryo parasite in the blood of a patient suffering from diarrhoea, and gave it the name of "Filaria sanguinis hominis." Observations of a similar nature were soon afterwards made by Corré, Silva Lima, and Sonsino

In 1876 a further step was made by (3)Bancroft in Queensland, by the discovery of the adult worm amongst the contents of an abscess, and he soon after discovered another worm in the fluid of a hydrocele. In the following year (4)Lewis discovered the adult worm in the blood clot from a lymph-scrotum. In 1878 (5)Manson made the important discovery that the mosquito acted as the intermediary host in the development of the parasite, and traced the

---

(1) Report of Sanitary Commissioner with Government of India, 1869.
(2) "On a Haematozoon in the Human Blood." Lewis.
(3) "Lancet." vol.I, 1878, p.464.
(4) "Lancet." vol.II, 1877, p.452.
(5) "China Customs Medical Reports." No.XVIII.

changes which the latter undergoes in the insect's stomach. (1)In 1880 the same observer traced the adult worm to its home in the lymphatic vessels, and, the same year,(2)discovered the phenomenon termed "filarial periodicity," and showed that plugging of the lymphatics was caused by ova prematurely expelled from the uterus of the parent. Such is a short history of the successive discoveries regarding the presence of this parasite in man. It now becomes necessary to discuss the connection between the parasite and elephantoid disease. It is important in the first instance, to bear in mind, that the presence of the 'filaria sanguinis hominis' in man does not necessarily involve disease; but on the contrary, a number of such filaria-bearing persons remain quite healthy. Under certain circumstances however, such persons become the victims of disease; and the disorders which most frequently manifest themselves, are those which form the subject of this paper, viz., elephantiasis and lymphatic varix. The following table, which is taken from (3)Manson's work, shows the proportion of filaria-bearing persons who at the same time suffer from disease, and the proportion of the latter who suffer from elephantoid di-

---

(1) "China Customs Medical Reports." No.XX.
(2) Idem. No.XXIII
(3) "The Filaria Sanguinis Hominis." p.80.

sease. From this table it will be seen that out of a total of 62 filaria-infected persons, 10, that is to say 16 per cent, were healthy. It is seen on the other hand that out of the 62 filaria-infected persons, more than 36, that is to say considerably more than one half, suffered from elephantoid disease. Another interesting point connected with this table is the fact, that out of 63 persons affected with elephantoid disease, 58·25 per cent, or 1 in 1·1,, were infected with filaride.

		Number examined.	Totals	Number of filaria cases	Total filaria cases	Corrected for temporary absence.	Proportion affected	Percentage contributed.
Elephantoid disease	Elephantiasis of leg	10	63	1	36	58·25	1 in 1·1	58·
	" of Scrotum	15		4				
	Lymph scrotum	13		10				
	" " & chyluria	2		2				
	Enlarged and varicose groin glands	23		19				
	Inflamed scrotum and fever	2	412	2	16	25·81	1 in 16	25·8
	Hydrocele	410		3				
	Other diseases			11				
	No disease	195	195	10	10	16·18	1 in 12	16·2
		670	670	62	62			100

In this table the correction for temporary absence of hæmatozoa is too great; whilst on the other hand, the number of cases of lymph-scrotum, or enlarged glands, is probably under estimated; as the patients were not always examined for these affections.

The almost constant presence of the hæmatozoa in cases of chyluria and lymph-scrotum, coupled with our knowledge regarding the behaviour of the parasite, and the manner in which it induces disease, point so strongly to the filaria as the cause of these diseases, that probably there are few who do not admit their association as cause and effect. But whilst most authorities admit that chyluria (and chylous discharges generally) are produced by the 'filaria sanguinis hominis', yet there are many who deny that a similar connection has been established in the case of true elephantiasis; and who look upon the latter as a disease quite distinct from chyluria and lymphatic varix. According to (1) Tilbury Fox and Farquhar the association of elephantiasis with chylous discharges is purely a coincidence. Manson however, has shown not only that the association of elephantiasis with chyluria and varicose lymphatics is very frequent, but that there is little, if any, room for doubt as to their etiological identity.

---

(1) "On certain endemic skin and other diseases," &c. Tilbury Fox & Farquhar.

The following are the more important facts which go to prove this identity.

I. Many cases are met with, in which, either chyluria, or lymph-scrotum, or both, are found co-existing with elephantiasis. Manson records a (1) case in which lymph-scrotum followed an operation for the removal of elephantiasis of the scrotum; also a (2) case in which elephantiasis of the leg followed the removal of a lymph-scrotum. He also records cases (3 & 4) in which lymph-scrotum and elephantiasis of the leg were combined; and a case (5) of lymphorrhagia in an elephantoid leg, combined with varicose groin glands and filariae in the blood. In the latter case chyluria subsequently developed. Aranjo of Brazil reports a case (6) in which both the adult and the embryo filaria were found in a person suffering from combined elephantiasis, lymph-scrotum, and chyluria. Another interesting case (7) is reported by Manson, in which elephantiasis and lymph-scrotum were combined, and both the exuded lymph, and the blood contained embryo filariae. After the removal of the scrotum no more filariae were found. Lewis in his work "On a Hoema-

(1) Appendix, Case I.
(2) do do II.
(3 & 4) do do III & IV.
(5) do do V.
(6) "Lancet," vol.I, 1878, p.464.
(7) "Medical Times & Gazette," vol.I, 1883, p.189.

tozoon," gives an exceedingly interesting case in which elephantiasis of the leg and scrotum, and chyluria, were all co-existent in the same individual.

Other cases of a similar nature have been published by (1) Carter, (2) Sir Joseph Fayrer, (3) McLeod, and others, and any surgeon who has practised in countries where the disease is endemic could probably furnish additional evidence of this nature.

II. The early history of many cases of elephantiasis of the scrotum resembles that of lymph-scrotum, and it is not unusual to meet with cases in which one disease is seen to be passing into the other. In the early stage of elephantiasis of the scrotum there is often exudation of lymph from the surface of the skin, and as the discharge diminishes in quantity, the scrotum commences to enlarge. Amongst my own cases of elephantiasis of the scrotum, I found that one third of the whole number, suffered from discharge from the surface, either previous to coming to the hospital, or during the time that they were under observation. Manson relates two cases (4) of a transitional nature.

III. Other proofs, if they were wanting, of the

---

(1) "Transactions of the Med: & Phys: Soc: of Bombay," 1861; and "Transactions of the Medico-Chirurgical Society," vol.45, 1862.
(2) "Clinical Surgery in India." "Practitioner", Aug. 1875. "Clinical and Pathological Observations in India."
(3) "Operative Surgery." K.McLeod.
(4) Appendix, Cases 6 & 7.

identity of these diseases, are furnished by the fact that they affect the same parts of the body, that they affect persons living under similar conditions, and that they are accompanied by the same kind of fever, and by inflammation of the lymphatics. These facts appear to me to be in themselves sufficient proof of the etiological identity of all these diseases.

If then elephantiasis is merely a modification of the same disease as lymph-scrotum and chyluria, there can be no reason to doubt that the former is filarial in origin. It is true that filariæ cannot always be found in the blood in cases of fully developed elephantiasis, and this fact has been the great stumbling block to many, in regard to belief in the filarial origin of the disease. But in elephantiasis proper, it is probable that the parent worm is often, if not always, choked by the stagnating lymph, and dies; and hence the embryo filariæ disappear. When the hœmatozoa are found in these cases, they are probably the progeny of another worm. The presence of the hœmatozoa in cases of elephantiasis should then be the exception, rather than the rule. And this is what we actually find to be the case. It must further be borne in mind, that filariæ are not always present even in chyluria or lymph-scrotum, and that

their absence in these cases is, in like manner, explained by the death of the parent worm. Against this, it has been urged that the death of the parasite, and consequent removal of the source of disease, should be followed by recovery of the patient. It must however be borne in mind, that although the parent worm may be dead, yet the lymphatic system has been so damaged, as to be beyond recovery. Another explanation of the absence of the hæmatozoa in cases of elephantiasis, is furnished by the fact, that all means of access to the blood has been shut off by the closure of the lymphatic channels on the proximal side of the parent worm. In such cases the young filariæ are found in lymph, either discharged spontaneously, or extracted from the lymphatic glands by means of a hypodermic syringe. (1) Manson gives several interesting cases in illustration of this fact, which will be more fully discussed when we come to consider the pathology of the disease. In one of these cases of Manson's, although the blood was examined daily, for nearly a month, no embryo was ever found in the latter, yet lymph extracted from the inguinal lymphatic glands contained filariæ. The value of these facts and arguments will be better appreciated when we come to

---

(1) "Lancet." vol.I, 1881. Appendix, Cases 4, 5, 8. 2. 3. 10.

study the pathology of the disorder, and when we understand the manner in which the parasite produces disease, and why, in one case, elephantiasis results, and in another, lymph-scrotum.

The manner in which the filaria sanguinis hominis finds its way into the body of its ultimate host will be more appropriately discussed in connection with the life history of the parasite. Here it will suffice to state that drinking water is the probable medium whereby it is introduced. The inhabitants of Eastern countries, and notably those of India, are so proverbially careless regarding the nature of the water which they drink, that the young filariae have little difficulty in finding their way into the stomachs of their hosts. Almost every Indian village is furnished with a stagnant pool of foetid water, which serves as bath, washing-tub, and drinking fountain, to many of the inhabitants; and it is needless to say that this water is never filtered or boiled. The following statements, taken from Waring's article on elephantiasis, will suffice to indicate the manner in which the disease is acquired in Eastern countries. (1) In the district of Shertullay, near Cochin, on the Western Coast of India, 21 per cent of the inhabitants

---

(1) "Indian Annals of Medical Science." vol.V, p.1.

are affected with elephantiasis. This district consists of a sandy strip of land, situated between the sea and a backwater, and the chief, if not the only, water-supply consists of "low shallow pools and tanks, and for the most part the water thus obtained, especially during the hot and dry seasons, and after heavy rains, is vilely bad, almost black in colour, thick, opaque to the eye, and brackish to the taste. This is used for drinking and bathing, and for other domestic purposes." This water no doubt forms the last resting place of many thousands of filaria-bearing mosquitoes.

PATHOLOGY.

As it is essential that we should be acquainted with the anatomy and life history of the parasite, before entering into the study of the pathology of the disease, I shall commence this part of the subject with a brief description of the former.

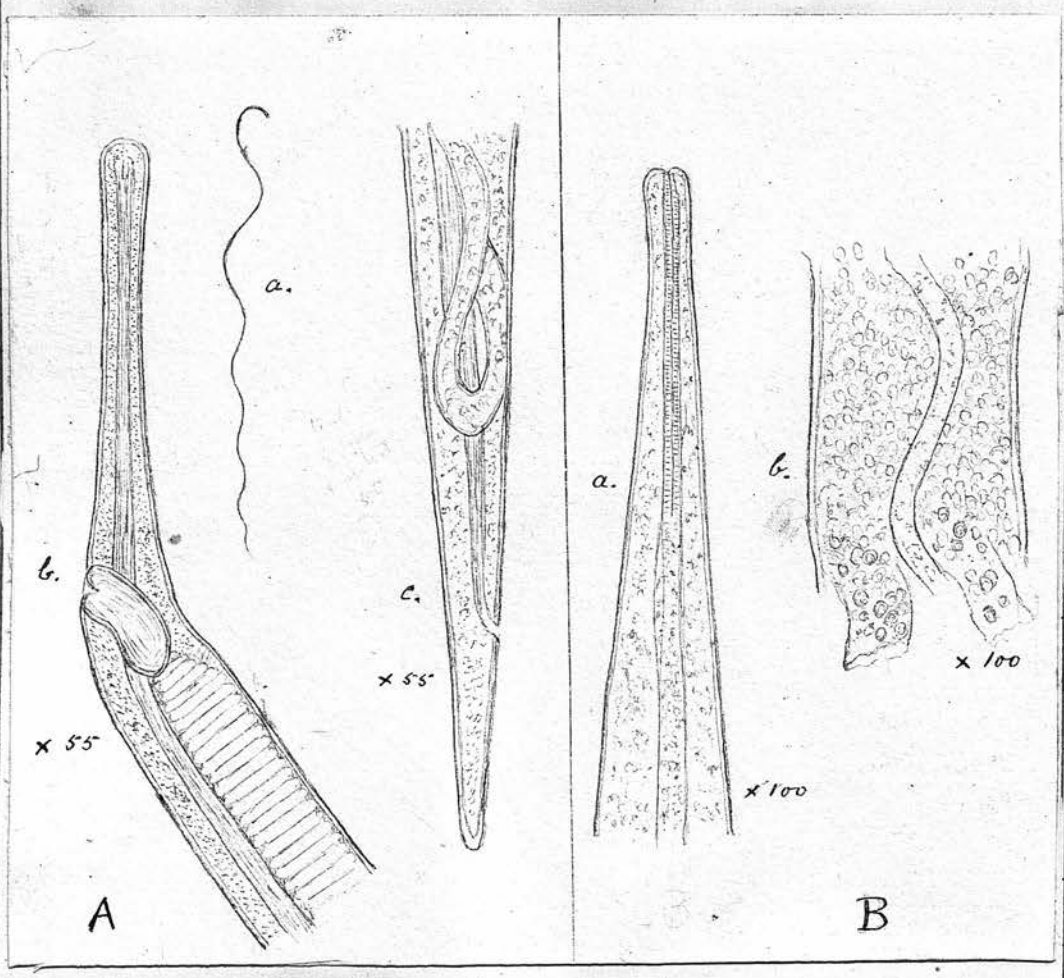
The description of the mature female parasite, as given by Cobbold, is as follows.

(1) "Body capillary, smooth, uniform in thickness; head with simple circular mouth, destitute of papillae; neck narrow and about one third of the width of the body; tail simple and bluntly pointed; reproductive

---

(1) "The Parasites of Man." T. Spencer Cobbold.

outlet close to head; anus immediately above the tip of the tail. Length 3½ inches; breadth $\frac{1}{90}$ in". The orifice of the vagina is $\frac{1}{10}$ in. from the head; and the vaginal pouch is $\frac{1}{100}$ in. in length, and separated from the two-horned uterus by a constriction. The uterine tubes extend nearly as far as the tail, and are filled with ova in various stages of development.



A. (After Cobbold) (a) Female, natural size. (b) Head and neck, oesophagus and vagina, × 55 diameters. (c) Tail-fold of uterine tube and end of intestine, × 55 diameters
B. (After Lewis) (a) Anterior extremity × 100 diameters (b) Portion of mature female; uterine tubes with ova in various stages of development; and intestinal tube, × 100 diameters.

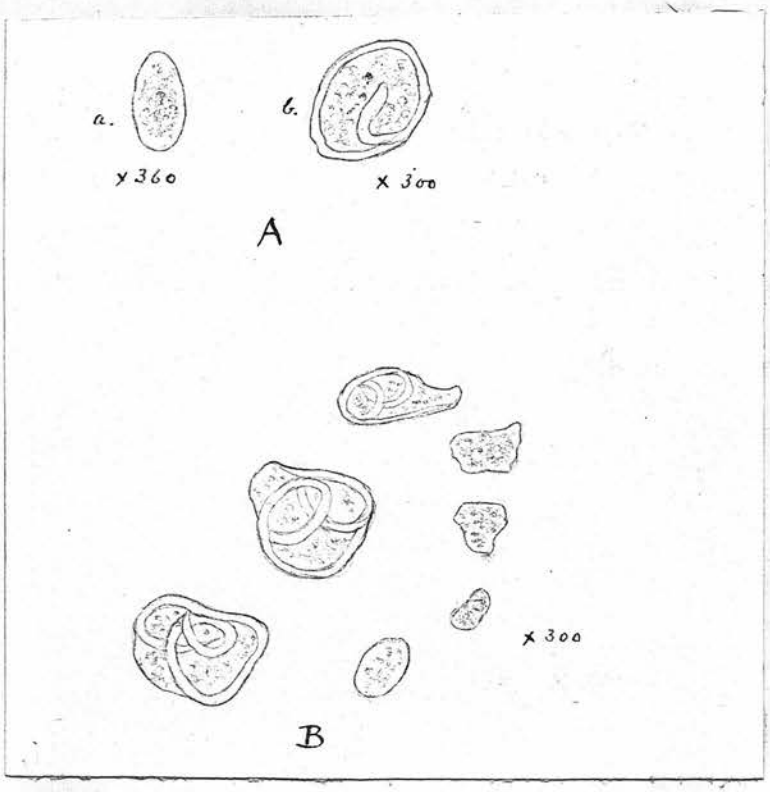
The oesophagus, which is $\frac{1}{59}$ in. in length, shades off gradually into the intestine. Our knowledge of the anatomy of the male parasite, is limited to the description of a small portion, half an inch in length, discovered by Lewis.(1) It appears to be smaller than the female, measuring only $\frac{1}{180}$ in. in breadth. In addition to the alimentary canal, it contained another tube, thought to be the spermatic duct.

(See illustration page 17)

The ova. The diameter from pole to pole, of the less advanced ova, varies from $\frac{1}{650}$ of an inch to $\frac{1}{1300}$ of an inch; whereas the corresponding diameter of those more advanced ova, in which differentiation of the embryo has taken place, varies from $\frac{1}{590}$ of an inch to $\frac{1}{700}$ of an inch. Each ovum is surrounded by a delicate pellicle, and although naturally ovoid in shape, varies in contour, as the result of pressure. In the smallest ova the outline of the embryo is not seen, but as they advance in size, and development progresses, the latter become distinctly visible.

---

(1) The Lancet, vol.II, 1877, pp.495 & 452. Lewis and Cobbold.



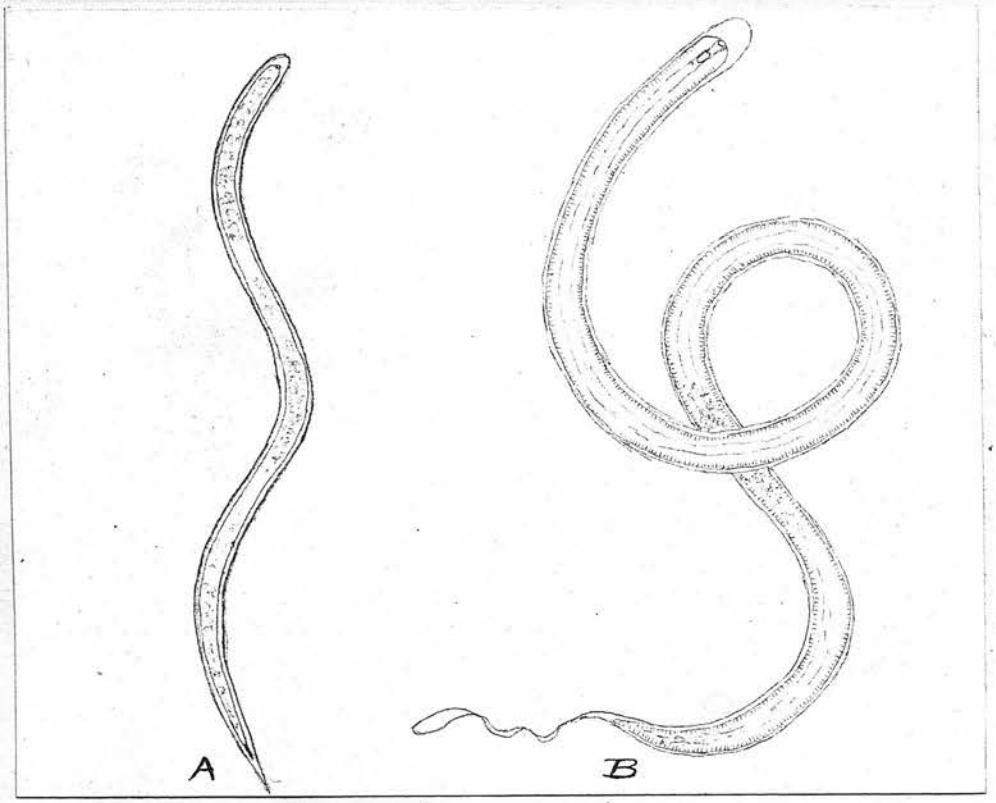
A. (After Cobbold) (a) Egg. (b) Inter-chorional embryo.

B. (After Lewis) Ova in various stages of development.

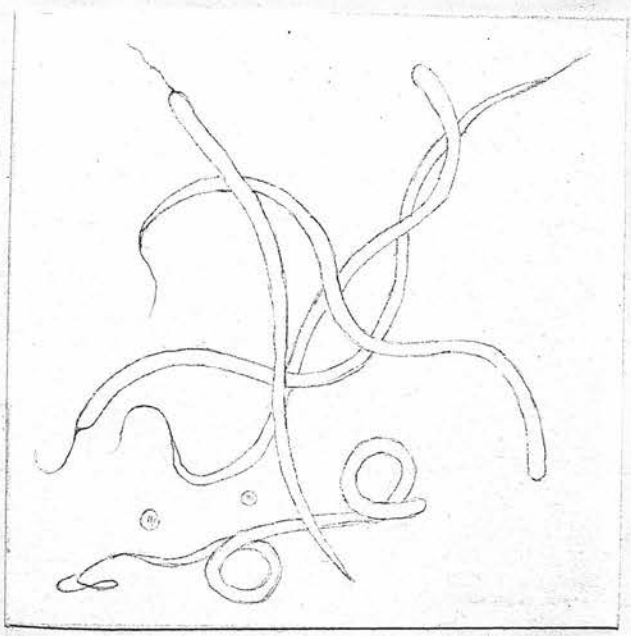
The embryos average $\frac{1}{3500}$ of an inch in length, by $\frac{1}{75}$ of an inch in breadth. Their length, however, may vary from $\frac{1}{3000}$ of an inch to $\frac{1}{7000}$ of an inch; and their breadth from $\frac{1}{75}$ of an inch to $\frac{1}{300}$ of an inch. The cephalic end of the young worm is "blunt or slightly tapering", and

occasionally contains a bright spot "suggestive of a mouth." The animal is enveloped in a hyaline envelope (the chorional sac), the whole area of which it does not quite fill; and this condition gives rise to considerable alterations in its appearance. "At one moment it may appear to possess a long tail, which follows it through the fluid like a string, whereas the very next moment, not a trace of "tail" can be seen even with the highest powers. The same phenomenon takes place at the cephalic end." "Every now and then a fine point, like a fang, appears as if darted forwards out of its substance; the next instant the creature may jerk its head on one side and the "fang" becomes bent, and drawn after it like a ribbon." "Every now and then by movement the head or tail are forced into the empty portion of the tube, and the lash-like extremity disappears." When first seen the embryos are in active movement, lashing about, wriggling, and "coiling and uncoiling" themselves, and their bodies appear to be translucent, although occasionally, with a high power, a few granules may be seen at the junction of the middle and lower third of the animal. As the activity of the embryo becomes less, it becomes granular; the bright spot at the cephalic end becomes more apparent; and immediately below the latter, an "elongated vacuole" appears. From this point downwards to the junction of the middle and lower third,

"a more or less clearly differentiated oesophagus(?) becomes likewise discernible, and appears to have a coecal termination." Beyond this point the digestive tract is less clearly defined. Under a high power very fine striae may be seen on the body.

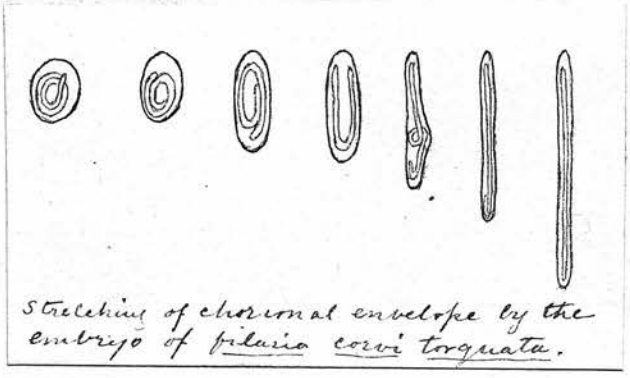


A. Embryo × 400, (after Cobbold.)
B. Embryo, (after Lewis.)



Living embryos after Lewis.

The conversion of the ovum into the fully developed embryo is, under ordinary circumstances, accomplished within the uterus of the parent; and takes place, not by shedding of its envelope, but by the gradual straightening out of the embryo itself; as the result of which, the shell of the ovum becomes the sheath of the embryo. A similar phenomenon takes place in the development of the "filaria corvi torquata," and the accompanying illustration, taken from Manson's work, shows, very clearly, the successive stages of this process.(1)



Stretching of chorional envelope by the embryo of filaria corvi torquata.

It follows from what has been said that the worm is viviparous, and the embryos may be seen in the lower part of the uterine tubes of the parent, lying at full length, "outstretched as we see them in the blood."

A most important fact, in its bearing on the pathology of elephantiasis, is the great difference between the diameter of the embryo, and that of the ovum. The diameter of the former being as small as that of a red blood

---

(1) "The filaria sanguinis hominis." p.25.

corpuscle, it is able to pass through the smallest capillaries and lymphatics; whereas the mature ova cannot pass through any vessel having a diameter less than $\frac{1}{700}$ of an inch.

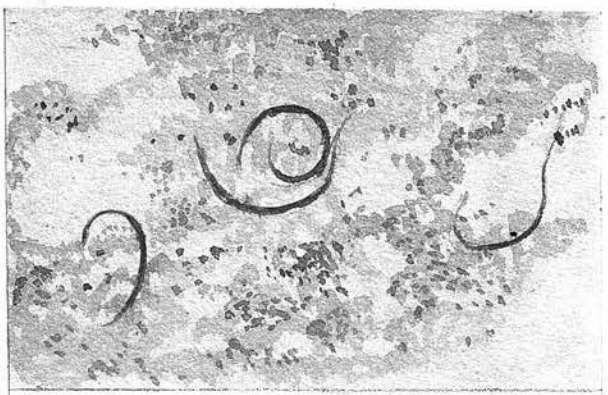
The usual and proper habitat of the mature parasite is a lymphatic vessel; a fact which has been established, not only by the (1) discovery of the worm in situ, but also by the fact that in cases of lymphorrhagia, the exuded fluid contains, not only the embryo filariae, but also the ova. (2) "The ovum being too large to pass from the outside to the inside of a lymphatic, and having no power to work its way, the parent that laid it" must have lodged within the lymphatics.

The parent worm being located in a lymphatic vessel, the young embryos when born are immediately carried away by the lymph stream, and passing successively through the lymphatic glands and vessels, find themselves eventually in the thoracic duct, from whence they issue directly into the blood. (3) Their presence in the blood may, provided proper methods be employed, be easily demonstrated. In some instances however, more particularly when disease has arisen, the discovery of the embryos in the blood is not so easy, and

---

(1) Appendix, Case IX.
(2) Manson. Op: cit: p.6.
(3) "Medical Times & Gazette." vol.II, 1877, p.590.

both Manson and Lewis repeatedly insist upon the great care and patience that must be exercised, in such cases, in searching for the embryos; whether in the blood, in the lymph, or in the urine. Manson, a most careful observer, says; "I would warn others against a hasty examination of the blood, and against concluding that whenever no filariae are found, none exist. For several years I have been in the habit of occasionally examining the discharge in lymph-scrotum and the blood also, but until lately never encountered the "filaria sanguinis hominis." The most important points to be observed in searching for the hœmatozoa, are, to make a free puncture in extracting the blood; to examine a number of slides, as well as every part of each slide; to use a low power ($\frac{1}{4}$ inch), and not too strong a light.



Filaria in the blood. ×70 Manson.

It has been estimated that one individual may have as many as 2,000,000 embryos in his blood at one time.

In countries where elephantiasis is endemic, the proportion of persons affected with filariae appears to be very large. (1) In Amoy, Manson found the hoematozoa in 10 per cent of the population; and making allowance for their temporary absence from the blood, he concluded that nearly 13 per cent of persons in that city were affected with these parasites. (2)Drs Patterson and Hall of Bahia made observations of a similar nature, and concluded that, without allowing for temporary absence of the filariae from the blood, 8 or 9 per cent of the inhabitants of that place were affected. Under ordinary circumstances the presence of these parasites does not appear to have any injurious effect upon the individual.

It is now necessary that I should give a short account of that most remarkable phenomenon, which has been termed "filarial periodicity", and which was discovered and investigated by Manson in the year 1880. (3) FILARIAL PERIODICITY. Under ordinary circumstances the young filariae are to be found in the circulation only during the hours of sleep. They begin to make their appearance towards sunset, and gradually increase in quantity up to midnight; after which the numbers

---

(1) "China Customs Medical Reports." No.XIV.
(2) "The Veterinarian." June, 1879.
(3) "China Customs Medical Reports." XXIII.

gradually diminish, until about nine o'clock in the morning, when they all disappear. (1)Dr Stephen Mackenzie made the discovery that by changing the habits of the patient, and making him sleep during the day and remain awake during the night, periodicity was inverted; that is to say, that the filariae appeared in the blood during the day and absented themselves at night. It appears that it is not the sleeping state itself that affects periodicity, but something connected with it, and occurring every twenty-four hours. This is proved by the fact that the embryos commence their entry into the circulation some hours before sleep, and begin to leave it some hours before the waking state. As Manson puts it, "The conditions favourable to the ingress of the parasites become developed ordinarily during the last few hours of the waking state, and they are slowly eliminated during the last few hours of sleep." The febrile condition also disturbs filarial periodicity. No clue to the cause of this remarkable phenomenon has hitherto been discovered.

(2)Mortimer Granville ascribed it to changes occurring in the blood, such as diminished rate of the blood current, increase of the amount of oxygen, and

---

(1) "Transactions of the Pathological Soc:"vol.XXXIII.
(2)"Quekett Club Journal." vols.V and VI, p.60.

lowering of the temperature. Whatever the cause of this procedure on the part of the hoematozoa may be, the purpose is evident; namely, the necessity of adapting themselves to the nocturnal habits of the mosquito. It further remains a matter of speculation as to what becomes of the embryos during their temporary absence from the blood.

Manson found that the embryos of the filaria immitis, which affect dogs, although they do not observe the same regular periodicity as do those of the filaria sanguinis hominis, yet at times are almost entirely absent from the blood; and during these periods, are collected, in great numbers, in the blood of the lungs.(1) "How they manage to maintain their position there against the blood current," he says, "I do not certainly know, but I suppose that they attach themselves to the inner surface of the vessels in some way, poosibly using their oval extremity as a sucker. Occasionally I have seen an embryo thus attach itself to a slide while under examination with the microscope." He was led to the conclusion that an analogous condition might obtain in regard to the filaria sanguinis hominis, and he believes that during the period that the embryo filaria is temporarily absent

---

(1) Filaria Sanguinis Hominis. p.46.

from the general circulation, "it lies resting and waiting for sunset in some of the thoracic or abdominal viscera."

What ultimately becomes of the enormous multitude of embryos to which the parent gives birth, is another question which awaits solution. It has been proved by the examination of the lymph discharged in cases of lymph scrotum and chyluria, that the production of embryos by the parent is not periodic, but nearly constant. We know moreover that the parasites are not short-lived in the blood, for they can be kept alive for several days on a slide. (1) Manson states that he has kept them alive on oiled slides for over 100 hours, and that they will live as long as the serum, in which they are preserved, remains fluid or viscid. But although no dead filariae have ever been discovered in the blood, yet Manson found (2) "numbers of [illegible] threads, about $\frac{1}{100}$ of an inch in length" whose appearance suggested "the idea that they were the collapsed sheath of the embryo, the body of which had disappeared by absorption or disintegration."

Whatever may be the ultimate fate of the great

---

(1) "Filaria Sanguinis Hominis." p.63.
(2) "Fil: Sang: Hom:", p.104.

mass of the hœmatozoa, or how long they may live in the blood, is, to us, only a matter of secondary interest; what is of more importance to know, is that, so long as the embryo filariae remain in the blood, they do not undergo any further development.

For the completion of the next stage of their life history, the intervention of an intermediary host is necessary.

THE INTERMEDIARY HOST. The animal which performs the rôle of an intermediary host is the female of a particular species of mosquito. This insect is distinguished from ~~the~~ other species of 'culex' by her small size, brown colour, and the absence ofmarkings on her abdomen, thorax, and legs. She is about $\frac{3}{16}$ of an inch in length, and has a small dark head, and a proboscis about two thirds the length of her body, with a bulbous extremity. When this animal, by means of her proboscis, pierces a blood vessel, a large number of the hœmatozoa, which are lashing about in the blood, become entangled, by their so-called "tails", around the proboscis; and are from thence conveyed, along with the blood, to the insect's stomach. The blood, which is found in the mosquito's stomach, contains a much larger proportion of hœmatozoa, than does an equal quantity of blood obtained by pricking the fingers of

the individual upon whom the mosquito has operated. Manson found that if pieces of cotton fibre were inserted into lymph which contained living filariae, the former soon became covered with great numbers of the parasites, who, in wriggling about in the fluid, became attached, by their tail or head lashes, to the cotton fibres. It is probable that the proboscis of the mosquito, when it enters a bloodvessel, becomes in like manner a means of entangling large numbers of young filariae. The greater portion of the filariae which thus reach the stomach of the mosquito are either digested, or expelled along with the foeces; only a few remain to undergo further development, and to pass through a series of metamorphoses.

METAMORPHOSES OF FILARIAE IN THE MOSQUITO'S STOMACH.(1)

The first changes manifested by the filariae are that they become less active in their movements; their bodies become striated in appearance; and the sheath becomes separated from the latter by a certain interval. After a time the sheath completely disappears, as well as the striated appearance of the body, and the animal then enters into a chrysalis stage.

In this stage the body becomes much shorter and

(1) "The Proceedings of the Linnaean Society" vol.XIV, Manson. "Transactions of the Pathological Society." vol.XXXII, Manson. "Report of the Sanitary Commissioner with the Government of India," No.XIV, 1877. Lewis.

broader, and filled with granular matter; the tail alters in shape, becoming filiform, and appears like "an appendage stuck on the sausage shaped mass." At this time a central cylinder of cell-like bodies appears, terminating, at one end, a little above the tail, and at the other, at "the semblance of a mouth." During the chrysalis stage the only movement exhibited by the animal is an occasional and vigorous movement of the tail. With this exception the animal remains quite passive. In the final stage the tail disappears, the body increases in length and diminishes in breadth, and gradual swaying movements take place. When the final metamorphosis has been completed the animal attains a length of about $\frac{1}{15}$ of an inch, and a breadth of $\frac{1}{500}$ of an inch; its head is crowned with three or four papillae; an alimentary canal and the rudiments of generative organs are visible; and movement becomes vigorous and incessant. The following illustrations, taken from Manson's work, demonstrate these changes.

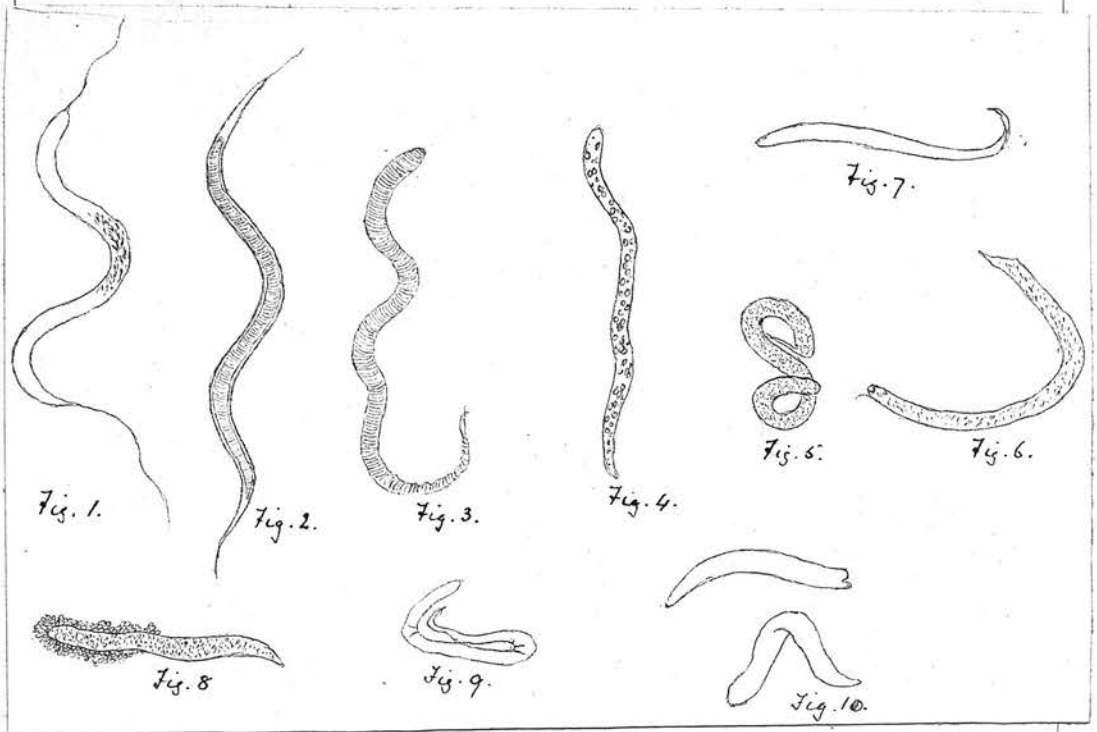


Fig.1. - Movements vigorous, but slowing down. Lash and oval movements distinct.

Fig.2. - Movements languid; sheath separated by interval from body, which is striated; 3 to 6 hours after ingestion.

Fig.3. - Movements languid; sheath gone; 8 hours after ingestion.

Fig.4. - Dead and undergoing degeneration or digestion.

Fig.5. - Movement intermittent, but often vigorous; body granular; jointed nature of tail; 36 hours after ingestion.

Fig.7. - Length $\frac{1}{90}$ in; breadth $\frac{1}{2500}$ in. No mouth or striation; few and faint granules; intermittent but vigorous movement of tail.

Fig.8. - Body thick and granular and imbedded in oily material; 49 hours after ingestion.

Fig.9. - Faint caudal movements; no striation, granulation, or structure of any sort visible. 50 hours after ingestion.

Fig.10 - Body homogeneous; slight indication only of tail; 63 hours.

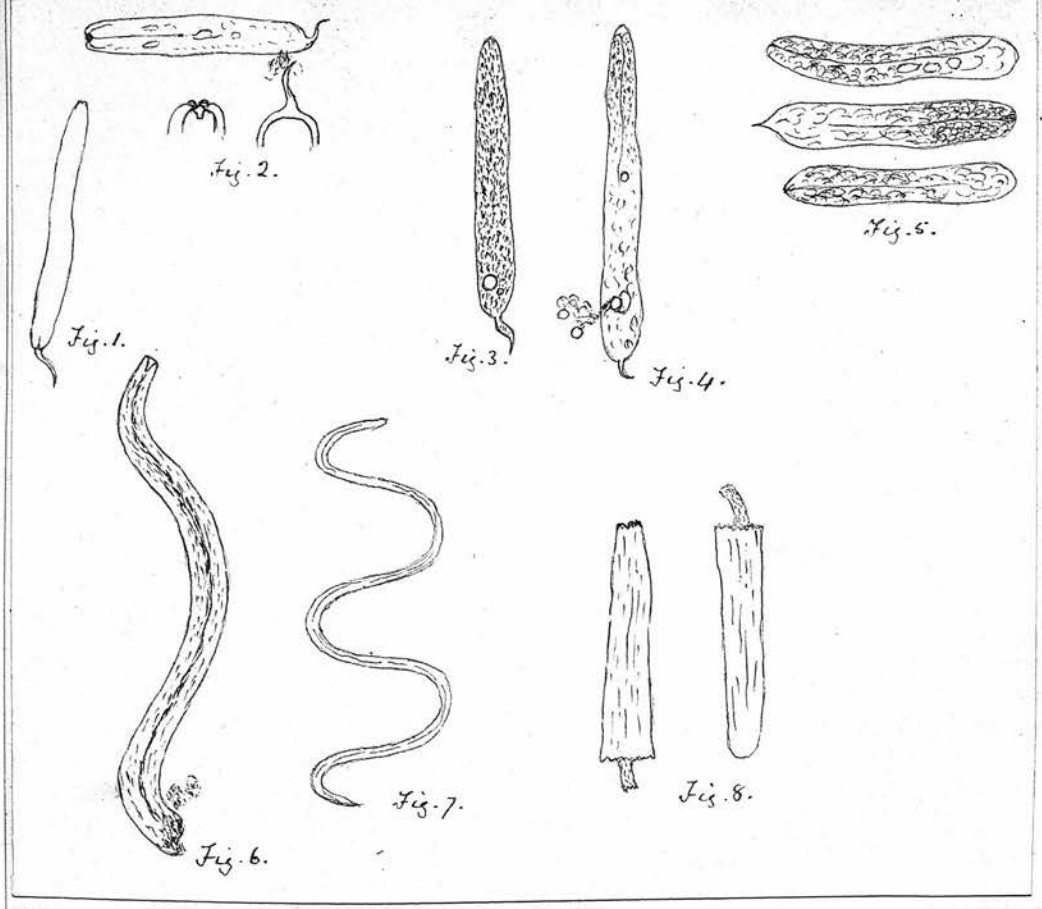


Fig. 1. - Tail distinct; indication of mouth; structureless or indistinct convoluted appearance; motionless; 80 hours or 4th day.
Fig. 2. - Distinct mouth 4 lipped; indications of alimentary canal; 5th day; Mosquito dead.
Fig. 3. - Body elongating; granular or cell-like in interior; indication of anus; 5th day.
Fig. 4. - Body longer; posterior end swelling; granular matter escaping from anus; alimentary canal indicated; tail shrinking. 5th & 6th day.
Fig. 5. - Body short and stumpy; mouth, alimentary canal and anus distinct; tail disappeared; large cells 6th day.
Fig. 6. - Body broader and more elongated; head and forepart of body in rapid swaying motion. 6th day.
Fig. 7. - $\frac{1}{50}$ of an inch long; transparent; constant motion.
Fig. 8. - Head and tail of No 7.; head crowned with four circum-oral papillae; ruptured end of oesophagus protrudes where body is torn across.

During the progress of these changes, which extend over about six days, the mosquito remains in a torpid condition slowly digesting the contents of its stomach, and maturing its ova, after which it deposits the

latter on the surface of the water and dies. Its body, falling into the water, soon becomes disintegrated, and the parasites escape. Whether the latter now pass directly with the water into the human stomach, or first enter the body of some other animal, and are thus transmitted; is not certain.(1) Manson has suggested that "Paludina", a large fresh-water univalve, may act as a medium in carrying the parasite into the human stomach. This mollusc crawls along the surface of the water, eating everything it finds, including the decomposing bodies of mosquitoes. The Chinese are, it appears, in the habit of eating these molluscs. The intervention, however, of any other intermediary host than the mosquito appears quite unnecessary. As Manson says , "there seems nothing wanting to fit it (the parasite) for an independant life and journey through the tissues of a human host. It possesses an alimentary canal; its head is armed with a boring apparatus, and it has sufficient strength and activity to wield this efficiently. It is also in the medium most likely to afford it an opportunity of gaining access to its final host." "Once in the human stomach, it soon bores its way into the thoracic duct, or some lymphatic vessel; and working up stream, in obedience to strange

---

(1) "Medical Times and Gazette". vol. ii, 1885, p.237

instinct, pierces the lymphatic glands and finally arrives at its permanent abode in some distant lymphatic vessel. Here it is followed by one of the opposite sex obedient to sexual instinct. The couple grow, and for years live together and breed, the progeny passing through the glands and into the blood, there to await their chance of a friendly mosquito to help them, as it had their parents, towards maturity." The faculty possessed by the 'trichina spiralis', and other human parasites, of finding their way to a suitable lodging in the body of their host, is well known; and there is no reason why the young filaria should not possess a similar instinct. (1) The male filaria probably also possesses the instinct, common to other parasites, of following up the track of the female.

Having now completed the description of the parasite, and the account of its life history, and the method by which it finds entrance into the body; I shall proceed to explain the nature of the circumstances under which its presence gives rise to elephantoid disease.

We have already seen that the presence of the 'filaria sanguinis hominis' does not necessarily in-

---

(1) "Proceedings of the Linnaean Society".vol.xiv.

volve disease. The parent worms may live for an indefinite period, discharging their embryos into the blood, without inconveniencing their host. In many such cases, however, a time arrives when a hitch occurs, and circumstances arise which result in blocking up of the lymphatic channels, and, as a consequence, serious disturbance of the nutrition of the tissues in the affected area.

ruction of nphatics

Our knowledge regarding the actual occurrences which give rise to blocking of the lymph channels in these cases, we owe entirely to Manson. (1) That able and zealous observer was the first to discover and demonstrate the fact, that obstruction of the lymphatics is the result, in most, if not in all, of these cases, of abortion of the parent worm, and plugging of the lymphatic channels by its ova. I have already drawn attention to the fact that if the uterine tubes of the parent are examined, they will be found to contain, not only fully-stretched-out embryos, but also young worms, which still remain coiled up within the chorional envelope. If the latter be prematurely expelled from the uterus of the parent, and launched into the lymph stream before their time, they will be carried to the neighbouring lymphatic

---

(1) "The Filaria Sanguinis Hominis". p.122.

glands, and being too large to pass through the minute lymph spaces, they will become impacted within the latter. Such are exactly the circumstances which give rise to elephantoid disease. The parent filaria who has taken up her abode on the distal side of certain lymphatic glands, suddenly aborts, and the ova, being carried to the glands, become impacted within the latter; and so give rise to obstruction. It is necessary at this point again to draw attention to the facts which go to prove that the filaria frequently inhabits the lymphatic vessels on the distal side of the primary glands. (1) Manson, in one of his cases, actually found the filaria lying in one of the lymphatics of the scrotum; and he reports other cases (2) in which embryos, as well as ova, were found in lymph taken from the inguinal glands, and also in lymph discharged from the surface of the scrotum. Cases have also been published by (3) Manson, Bancroft, and Lewis in which the parasite was found in abscesses connected with enlarged and varicose inguinal glands. (4) The cases in which the ova were

---

(1) Appendix. Case ix.
(2) do Cases x, xi, xiii. i. ii. iii. iv. v. viii.
(3) do Case x.
(4) do Cases xi, xii.

found in lymph extracted from the inguinal glands, and also in lymph discharged from the skin, prove that the filaria may, and does, abort. Cobbold also discovered the ova in the urine, and according to (1) him, they were also seen by Salisbury. "If we reflect on the long life of the parasite; the activity of its generative functions; the exposed position it often occupies in the legs or scrotum; its liability to injury therefore from mechanical violence; of the sicknesses of the host, his fevers and blood-poisonings; the miscellaneous food he consumes, some of which may act on the uterus of the worm, as they act on that of the human subject; we can readily understand how abortion is brought about. We know the mature parasite sometimes dies; what kills her, applied in a less degree, may readily cause her to abort." It is not improbable that some drugs, such as quinine and mercury, may cause the worm to abort. It is not uncommon to find that the onset of the disease has been coincident with an attack of syphilis, and indeed many of the older writers ascribed the disease to syphilis. May not the syphilitic poison, or the remedies used for its cure, have caused the filaria to abort. The worm may also, like the human being, acquire the habit of aborting.

---

(1) "Parasites of Man". T.Spencer Cobbold.

Having thus traced the causes of the initial obstruction of the lymphatics, it becomes necessary now to study the sequence of events which follow the primary lesion. The ova-laden lymph regurgitating from the obstructed channels, is carried onwards by anastomosing vessels, which, in their turn, become blocked in a similar manner to the first. In this manner, if there be a large number of ova, the whole set of primary glands may be rendered impassable. The most frequent habitat of the parasites being the distal lymphatics of the lower extremities and scrotum, embolism most frequently occurs in the inguinal glands. If the inguinal glands on one side of the body become completely blocked, the lymph may be carried, by anastomosing vessels, to the scrotal lymphatics, and from thence to the glands in the opposite groin; and the latter, in their turn may be rendered impassable. Thus it will be seen that the amount of obstruction will vary in different cases, and will depend, to a certain extent, upon the number of extruded ova. The area affected by elephantoid disease depends primarily upon the extent and location of the obstruction of the lymph passages, and upon the sufficiency, or otherwise, of the anastomosing circulation.

It has been asserted by(1) Prospero Sonsino and others that obstruction may be caused by the parent worm itself. That this does occur in some cases is certain, but the obstruction being limited to the vessel in which the worm is lying, does not cause any extensive disturbance of the circulation of the lymph. (2) Mere obstruction of a lymphatic vessel does not produce oedema, because of free anastomosis. The cases in which Manson, Bancroft, and Lewis found the parent worm in the contents of abscesses, were instances in which the parent worm had caused obstruction and set up irritation. (3) Lewis appeared to be of opinion that obstruction might be caused by the embryos themselves, and (4) Cobbold thought that, as in the case of the 'trichina spiralis', evil effects would not be manifested until very large numbers had been produced; thereby implying his belief that the embryos themselves might be the cause of the disease. No evidence, however, has yet been adduced to show that the embryos of the 'filaria sanguinis hominis' ever cause obstruction of the lymphatics. We know, on the other hand, that many individuals live for

---

(1) "Lancet", vol.i,1882. p.825.
(2) "British Medical Journal", vol.ii,1884. p.354, Phillipson.
(3) "On a Haematozoon".
(4) "Transactions of the Epidemiological Society". 1881-1882, p.116.

years, with enormous numbers of these embryo parasites in their blood, without their health being in any way interfered with. Many of the lower animals also possess their own particular variety of filarial worm, which gives birth to swarms of haematozoa, without the latter affecting the health of their host. In China, according to Manson, half the dogs, all the magpies, and one third of the crows harbour filariae.

It will now be necessary to discuss the nature of the lesions which result from obstruction of the lymphatic glands, and why, in one case, true elephantiasis is produced, and, in another, lymphatic varix. (1) Dr Curnow states that when obstruction to the onward flow of lymph occurs, "the lymphatics may dilate and rupture, or local oedema of the connective tissue may take place, according to the degree of obstruction". These words serve as a key to the whole matter. If obstructtion be complete, elephantiasis results; if incomplete, lymphatic varix is produced. If all the channels which normally drain the affected area are obstructed, and the anastomosing channels

---

(1) "Gulstonian lectures", Lancet, vol.i, 1879,p.361.

either fail to afford relief, or become themselves obstructed, then complete stasis results, and is followed by lymphatic oedema and lymphangitis. When accumulation of lymph occurs within the tissues, whether it be due to increased inflow from the blood vessels, as in inflammation, or to diminished outflow through the lymphatics, as in elephantoid disease, the result is thesame; namely, stagnation of lymph, or lymphatic oedema. That this should be so is easily understood when we consider the functions of the lymphatics, as "regulators of turgescence" (Hermann). (1) "The condition in which there is increased pressure of parenchymatous fluids, and which is removed by increased activity of the absorbents, is called oedema. We may say that a system of drainage is continually in operation in the tissues, in which fluids are poured out of the blood vessels by transudation, percolate the surrounding cellular tissues, and finally flow away through the lymphatics." If the outflow becomes impeded or obstructed, overflow and stagnation of the fluids take place.

So far the effects are such as might be caused by any transient obstruction of the lymphatic system,

---

(1) "Elements of Human Physiology." L.Hermann. 2nd Edition, p.168.

and every surgeon is familiar with cases of lymphatic oedema and inflammation, resulting from pressure on the axillary glands by splints or bandages. In the latter cases, however, as soon as pressure is removed, the lymphatics resume their normal function, the swelling is removed, and inflammation disappears. In elephantoid disease, it is also possible that the obstruction may be removed, either wholly or partially, before any permanent damage has been effected. If wholly removed, the patient's troubles are for the time being at an end, but if only partially removed, lymphatic varix will, as we shall see, be developed. In the majority of cases, however, the damage to the lymphatic channels is irretrievable, obstruction continues, and stagnation of lymph within the tissues occurs.

Elephantiasis

(1) "OEdema from lymphatic obstruction soon becomes solid, from the formation of an immature connective tissue (the so-called mucous-tissue)" and leads to "local hypertrophy or giant growth". This hypertrophy results from the passive outflow of lymph (2) "the mere pressure of this lymph, exuded under

---

(1) Curnow, op: cit:.
(2) Bradley, "Medical Times and Gazette", vol.i,1880. p.660.

pressure, (lymph rich in cells) directly leading to increase of the connective tissue." Although the rapidity of the growth of new connective tissue may, and does, vary, yet it is always progressive; and the ultimate size of the resulting tumors is usually determined only by the age to which the patient lives. In addition to this slow yet progressive hypertrophy, the result of obstructed outflow of lymph, there are also occasional active additions to the new growth; the result of periodic attacks of inflammation to which the diseased tissues are liable.

Periodic attacks of inflammation. When once any portion of the lymphatic system has become permanently damaged, the tissues drained by the affected part become susceptible to periodic attacks of lymphatic oedema and lymphangitis. Any unusual exertion on the part of the individual, giving rise to increased functional activity of the absorbents, or any injury, or a chill resulting in congestion, are liable to be followed by lymphatic oedema and erysipelatous inflammation.

(1) "In cases of lymphatic oedema dependant on obstruction in the lymphatic capillaries, it will be

---

(1) Bradley. op: cit:.

found, with few exceptions, that the patients are subject to recurrent, although it may be ephemeral attacks of dermic inflammation, erythema, or perhaps erysipelas." (1) Mr Hutchinson noticed the connection between frequently recurring erysipelas and elephantiasis, but he apparently considered that the former was the starting point of the disease. In true elephantiasis, the attacks of erysipelas are secondary to, and the result of, an obstructed and damaged lymphatic system. These facts serve to explain the cause of the recurrent attacks of inflammation to which the subjects of elephantoid disease are liable.

Some authorities are, I believe, of opinion, that there is one form of elephantiasis which is the result of vaso-motor disturbance, but I am unaware whether any evidence has yet been brought forward to prove this theory, or not. On the other hand, it has been stated by (2) Lewaschew, that the vaso-motor nerves do not exert any direct influence on the lymphatics.

---

(1) "Medical Times and Gazette", vol.i, 1883.
(2) "Lancet", vol.ii, 1886. p.263. (Union Médicale, No. 86).

To sum up the foregoing remarks on the processes involved in elephantoid disease, it may be said that the sequence of events is as follows: - embolism and complete obstruction of the lymphatic glands; passive outflow of lymph; progressive increase of connective tissue elements; and recurrent attacks of lymphangitis, resulting in periodic additions to the bulk of the tumor.

Lymphatic varix. Having thus far traced the pathological processes which are involved in the production of elephantiasis, we have now to follow out the processes which result in the development of lymphatic varix. It has been seen that in elephantiasis, in spite of anastomosis, all the glands which can give passage to the lymph becoming successively plugged, the fluid comes to a complete standstill. In some cases, however, one or more of the outlets for the lymph remain patent, and the current, although much diverted from its original course and much impeded, still continues to flow onwards. The impediment to the circulation results, not only in diminished rapidity of the current, but also in increased tension of the lymphatics, and the latter causes, in its turn, dilatation and varicosity of the

lymphatics. If the pressure becomes sufficiently great, the superficial lymphatics give way and lymphorrhagia results. It is moreover probable that in many cases, although all the glands have become obstructed, yet the discharge of lymph from the surface, by relieving tension, prevents complete stagnation and the establishment of true elephantiasis. I have already alluded to the fact that many cases of elephantiasis in the early stage of their history, suffer from lymphatic varix and lymphorrhoea, but after a time the discharge gradually diminishes and finally ceases, and elephantiasis is established. The removal, by operation, of the tissue which permits the escape of lymph, may, in like manner, produce elephantiasis in some other part of the body. Manson relates a case in which the removal of a lymph scrotum was followed by elephantiasis of the leg, and another in which elephantiasis developed in the cicatrix, after removal of a lymph scrotum.

The nature of the tissues, involved in the disease, influences, to a certain extent, the result as to which variety of elephantoid affection will develope. In the scrotum, the lymphatics are not only more numerous than in other parts of the body, but are also, according to (1) Curnow, remarkable

---

(1) Op: cit:.

for their varicosity. These peculiarities, combined with the laxity of the tissue in which the vessels are situated, render the scrotum more liable to be affected with lymph varix and lymphorrhagia than any other part of the body. (1) Manson points out that when there is a powerful dartos and thick skin, lymph scrotum is not so likely to develop as when the tissues are lax. In the limbs, on the other hand, the tissues being less lax and the lymphatics less numerous, complete obstruction and oedema are the usual result; dilatation of the lymphatics and lymphorrhagia are uncommon. Curnow is of opinion that inefficiency of the valves, and degeneration of the muscular tissue in the glands and in the walls of the lymphatic vessels, are also factors in determining the production of lymphatic varix. Obstruction of the lymphatics of the lower limbs may be relieved by discharges from the scrotum, and if the latter be removed, in such cases, elephantiasis will develop in the former.

It must be borne in mind that elephantiasis and lymphatic varix may not only be found side by side in the same part of the body; but the one may pass al-

---

(1) "Transactions of the Pathological Society", vol.xxxii.

most insensibly into the other.

Why this should be so, is easily understood if we bear in mind the cardinal fact that, one is the expression of lesions which result in stagnation of lymph, whilst the other is the expression merely of impeded flow of lymph and increased tension of the lymphatics.

In lymphatic varix, as in elephantiasis, there is some passive exudation of lymph; but to a minimum degree.

There is moreover a similar susceptibility to recurrent attacks of inflammation.

Morbid Anatomy.

Elephantiasis. When the disease is seen in its initial stage, before any permanent thickening has taken place, we find oedematous swelling and redness of the surface. This lymphatic oedema is distinguished from venous oedema, by the greater firmness and the brawny condition of the part. The redness is due to inflammation of the superficial lymphatic capillaries; the larger lymphatic vessels being only affected in a minor degree. (1) When the deep trunks are involved there are indurations of

---

(1) Curnow, op: cit:

variable extent, but fixed, and giving the idea of oedema rather than inflammation.

When elephantiasis has existed for any length of time and the disease is fully established, the most evident alteration in the appearance of the part is hypertrophy, but the enlargement not being uniform, there is also deformity. When the limbs are affected the deformity is particularly manifest; those members becoming huge, shapeless and unwieldy. When the scrotum is affected the enlargement is more uniform, but attains a greater size, and the penis soon becomes embedded and lost to view. The enlargement usually continues to progress throughout the life of the patient and its ultimate size is determined by the longevity of the patient. The skin covering these tumors is often thrown into large folds, and in places where the corium is firmly blended with the deep inelastic fascia, as in the palms of the hands, soles of the feet, groins, sides of the perinaeum, ankles and wrists, there is no swelling. The skin generally loses its smoothness and assumes a somewhat warty appearance from hypertrophy of the papillae, and there is sometimes a tendency to desquamation, and occasionally an ichthyotic condition. Cracks, fissures, and ulcers often form, especially between the folds of the skin. The

consistence of the tumor is generally hard, but elastic and india-rubber like; in some places, however, it is less dense, and more resembles the condition found in cases of lymphatic varix . If examined during an inflammatory attack, the usual appearances will be modified by the evidences of erysipelatous action, such as have already been described. Sometimes the surface of the tumor presents an eczematous-looking condition, developing raw patches, which pour forth a watery discharge.

On section the tumor is found to consist of an outer rind or shell, of variable thickness, but dense structure; and an inner portion, which is soft, succulent, and 'blubber-like', and which gives exit to a large quantity of fluid. The outer portion is of dense consistence, white or yellowish in colour, and consists of bands of fibrous tissue which interlace in every direction, and its structure corresponds in appearance with that of fibroid tumors. The inner portion, although soft and gelatinous in appearance, is in reality of a tough consistence, and, like the outer portion, is composed of fibrous tissue; but it is less compact, and its meshes are permeated by a large quantity of fluid. (1) Paget describes these

---

(1) Paget, "Surgical Pathology".

elephantoid tumors as consisting "mainly of over-growing fibro-cellular tissue, which, mingled with elastic tissue, and with more or less fat, imitates in general structure the outer compact layer of the cutis. Their tissue is always closely woven, and very tough and elastic. In some cases it is compressible and succulent, as if anasarcous, and it yields on section a large quantity of serous looking fluid. In others it is much denser, interlaced with strong shining bands, like those of a fascia."

In extreme cases the intermuscular connective tissue becomes affected and the muscles undergo fatty degeneration; the bones also become thickened.

The microscopical appearances show that the growth consists, in various proportions, (1) of "the usual textures of the cutis, and subcutaneous tissue" The epidermis may be very little modified, but usually there is some (2) increase in the granular and horny layers. The dermis is enormously thickened, and consists of bundles of fibrous tissue perpendicular to, as well as parallel with, the surface. The ducts of the sweat glands are elongated in proportion to the increase in depth of the cutis, but the glands

---

(1) Paget, "Surgical Pathology".
(2) Cornil, "Lancet", vol.ii, 1883.

themselves, and the hair follicles, are not modified to any appreciable extent. The capillaries are dilated and thin-walled; the blood vessels numerous and enlarged; and the lymphatics occasionally dilated. When the scrotum is affected, there is a large amount of unstriped muscle found in narrow bands throughout the tissue, being the hypertrophied fibres of the dartos. After an elephantoid scrotum has been removed from the body, during life, alternate contractions and relaxations of the dartos, cause corresponding contraction and expansion of the tumor; and these movements continue for a considerable period after the mass has been removed.

Lymphatic varix. In lymphatic-varix the thickening of the skin and sub-cutaneous tissue is very slight, (1) but the tissues of the affected part become remarkably soft and easily compressible, and the skin, which is corrugated, imparts a characteristic sensation of silkiness to the fingers. The surface is covered with vesicular-like elevations, which vary in size from that of a pin's head, to that of a pea; but these elevations differ from true vesicles in having thicker walls, and in having less clearly defined margins. Besides these vesicular elevations

---

((1) Appendix, Case xiii.

bunches of varicose and turgid lymphatic vessels are often seen, projecting the skin at various points. Where there are a number of enlarged trunks aggregated together, as over the inguinal canal and in the upper part of the scrotum, they may be felt between the fingers, but slight pressure emptying them of their contents, they speedily collapse. When one of the vesicles or an enlarged lymphatic vessel is punctured, a stream of lymph is ejected with considerable force, and continues to flow for some time; after which it gradually slackens, and finally ceases spontaneously. Examination of the diseased tissue shows it to consist of numberless lymph channels ramifying in every direction throughout the slightly hypertrophied subcutaneous connective tissue. These lymph channels vary in diameter, from that of a probe to dilatations $\frac{3}{4}$ of an inch in diameter; and the smaller ones terminate in the vesicular elevations, already described.

Microscopical examination shows changes in the dermis and sub-dermic tissue, similar to those found in elephantiasis, but very much less in degree.

The lymphous discharge.

The fluid which is poured out from the punctured

lymphatics is at first quite limpid, but gradually becomes less clear, and often tinged with red. It resembles in all respects the fluid which exudes spontaneously from the skin in cases of lymphorrhagia, and like the latter, coagulates rapidly on exposure to the air. In the course of twelve hours or so, the coagulum resolves itself into a fluid portion, and a flocculent sediment. In many cases, although the fluid which is at first poured out is quite clear and of a faint straw colour, yet the later portion is opalescent, milky, or sanguineous. In one of (1) Manson's cases the first portion of the spontaneously exuded fluid was quite white, and the last portion dark red; and "an incision into one of the varices gave vent to a large stream of dark brown blood-like lymph."

I believe that opalescence and a pinkish hue of the fluid may be accounted for, to a certain extent, by admixture with the products of inflammation. (2) "In all cases of wounds of the normal peripheral lymphatics the fluid which exudes is generally limpid," but "it may occasionally be yellow or even pink, that is to say, it is either pure or mixed with the ordin-

---

(1) "Filaria Sanguinis Hominis", p.95.
(2) Curnow, op: cit:

ary products of inflammation." Some authors believe that the red colour, when present, indicates the existence of some communication between the blood vessels and the lymphatics; but Manson has pointed out, that any such communication is not only exceedingly improbable (none exists in the healthy state), but that the red colour of the lymph can be accounted for in another manner. According to him, the changes in the appearance of the lymph are brought about by its regurgitation through the lymphatic glands, and are a proof that the obstruction is situated high up in the lymphatic system. The higher up in the lymphatic system the seat of obstruction, the more opaque will be the fluid discharged, and the more often will it be of a red colour.

(1) Vandyke Carter, in treating of chyluria, appears to support this opinion, and believes that the seat of obstruction determines the nature of the discharge. Both of these authors consider that the changes which take place in the lymph are the result of its progress through successive series of lymphatic glands, and are evidence of its natural development and elaboration. If the obstruction be

---

(1) Vandyke Carter, "Transactions of the Medical and Physical Society of Bombay", 1861.

situated in the first series of glands, these changes do not take place, and the lymph remains colourless, or straw-coloured.(1) Curnow believes that the presence of fat globules is due to "degeneration of lymph-cells crowded together", and "of cells produced by proliferation of the lining endothelium of the spaces and vessels." (2) Letulle, in treating of chyliform ascites, thinks that all such cases are primarily inflammatory, and are due to granulo-fatty degeneration of inflammatory products.

I have already stated my belief that the slight changes in the nature of the fluid, which are so common, may be explained by admixture with the products of inflammation. I think, however, that there can be no doubt that when the fluid is quite white and milky, and afterwards becomes sanguineous, its nature is dependent upon an obstruction seated high up in the lymphatic system, in the neighbourhood of the receptaculum chyli, or in the thoracic duct itself. In such cases the milkiness is not due to fatty degeneration of lymph cells, but to development and elaboration of the lymph, in its passage through the lymphatic glands. It is quite possible, however,

---

(1) Curnow, op: cit:
(2) "Rèvue de Medecine", Sep., 1884.

that in the cases of so-called "galactocele", there has been fatty degeneration of the corpuscular element of the pent up fluid.

The lymphatic glands, in cases of elephantiasis, are not only enlarged, but of firm consistence, whereas in cases of lymphatic varix they form an exceedingly soft and collapsible mass, which, when situated in the inguinal region, has sometimes been mistaken for a (1) hernia. The sensation, however, which they impart to the fingers is quite characteristic, and could not be mistaken by anyone who had previously examined such cases. The large soft mass consists not only of enlarged and collapsible glands, but also of a number of dilated and varicose lymphatic vessels surrounding the former. According to Vandyke Carter (2) the enlarged glands are liable to changes of dimensions, and particularly to an increase in size after meals. Were it possible to obtain an examination of the glands during the initial attack of the disease, we should probably find them to be swollen and con-

---

(1) "Transactions of the Medical and Physical Society of Bombay", 1861, Amussat, quoted by Carter.
(2) Idem.

gested; and on microscopical examination we should find the lymph spaces impacted with ova, and filled with the products of catarrhal inflammation. These products, according to (1) Cornil, consist of round and granular lymph cells, and large cells containing many nuclei; the latter proceeding from the flat cells which line the reticulum. When the disease is fully established the glands become, not only enlarged, but hard; the hardness being due to increase of connective tissue elements. The enlargement of the glands in cases of lymphatic varix is due, chiefly, to dilatation of the lymph spaces.

When the disease affects the scrotum, the testicles may become diseased. In a great number of cases one or both organs are affected with hydrocele; often of very large size. Sometimes the testicles are atrophied, and sometimes they undergo calcareous changes; and they are often surrounded by a layer of dense fibrous tissue, the product of old attacks of inflammation. This layer of dense tissue is insensibly blended, on the one hand with the tunica vaginalis, and on the other, with the softer tissue outside itself; so that it becomes impossible, in such cases, to shell out the testicles. When we consider

---

(1) "Journal de l'Anatomie", Cornil.
"Lancet", vol.ii, 1878, p.547.

how liable to inflammation the scrotum is, in the early stages of the disease, it is easy to understand the origin of this layer of dense tissue. (1)Macnamara describes a case in which atrophy of the testicles followed compression of the 'vas deferens' by the growth of dense tissue round the organ.

The testicles are sometimes enlarged, but in these cases the diseased condition is probably due to causes other than elephantiasis.

Diseases associated with elephantoid affections

The association of chyluria with elephantoid disease has already been discussed. It is now necessary to notice briefly some other disorders which are frequently associated with elephantoid affections. There is little doubt that the presence of the 'filaria sanguinis hominis' often gives rise to abscesses, and both Bancroft and Manson found the mature worm in the contents of such abscesses.

Many patients give a history of having had abscesses in the parts affected with elephantoid disease, and it is quite common to find the evidences of such in the form of cicatrices.

---

(1) "Indian Annals of Medical Science", vol.ii.

The very frequent association of hydrocele with elephantiasis of the scrotum has already been noticed and the proportion of such cases, according to (1) McLeod, is 56 per cent. Hydrocele, independent of scrotal disease, is not uncommon among filaria-infected persons.

Attacks of acute orchitis and hydrocele, preceded by rigors and fever, are not uncommon in India, and such cases are, in my opinion, filarial in origin.

Acute synovitis of the knee joint, preceded by rigors, is also common in that country, and is, in my belief, due to a similar cause. A patient once came under my care suffering from synovitis, which had commenced four months previously with rigors. He gave a history of once having suffered from an attack of chyluria, and subsequent to his admission to hospital, chyluria re-appeared, and the patient ultimately died.

According to (2) Lewis, diarrhoea, dysentery, and ulceration of the intestines are sometimes associated with the presence of filariae; but the cases met with by him, have been too few to establish any definite connection between these diseases and elephantiasis.

---

(1) "Operative Surgery."
(2) "On a Haematozoon in the Human Blood."

(1) Dr O'Neil gives an account of an affection termed "craw-craw", which is prevalent on the West Coast of Africa, and which he thinks is filarial in origin, because he found embryo filariae in the papules which occur in the course of the disease. His description of the disease, however, so closely resembles that of 'itch', that it is difficult to believe that these were not cases of the latter disease, occurring in persons whose blood contained filariae. He obtained the filariae by slicing off a portion of the papules, and no doubt, the filariae thus obtained, came from the blood.

Manson met with cases in which rheumatism, stricture of the oesophagus, heart disease, cataract, haematemesis, and ulceration of the cornea were associated with the presence of filariae in the blood; but there is no reason to suppose that these were anything but accidental complications.

Geographical distribution.

As a correct appreciation of the facts concerning the geographical distribution of elephantoid disease cannot be obtained without a knowledge of

---

(1) "Lancet", vol.i, 1875, p.265.

the causes which lead to its production, I have postponed until now the discussion of this branch of the subject.

The area in which elephantoid disease is endemic embraces a large part of the tropical and subtropical portions of the globe. It is met with in Arabia, Hindustan, Burmah, the Malay Peninsula, China, Mauritius, Queensland, the Society Islands, and other islands of the Eastern Archipelago, Egypt, Cape Colony, Brazil and other parts of South America, and in Barbadoes and other of the West Indian islands.

But although the disease is endemic in so large a number of countries, the actual endemic area in each country is limited to a narrow strip of land near the coast. According to Day, the disease is limited to the district within ten miles of the sea. It is not endemic in any inland districts. The area of distribution of the disease is determined by the presence or absence of the particular species of mosquito, which acts as the intermediary host in the development of the 'filaria sanguinis hominis'. I have already described the manner in which the young filaria undergoes development in the stomach of this particular species of mosquito. We know further that other species of mosquito are incapable of perform-

ing the rôle of intermediary host.(1) Dr Wickham Myers of South Formosa has demonstrated the fact that when other species of mosquito take up the filaria-infected blood, the embryo parasites are all destroyed and digested, and never live to undergo further development.(2) He moreover observed that although many persons affected with filarial disease came over to the island of South Formosa from the mainland of China, yet the disease has never spread to the inhabitants of the island itself. This fact he explains by the absence from that island of the proper filaria-breeding mosquito. He states that although for a number of years he has caused a careful search to be made in the island for this mosquito, he has never succeeded in obtaining a single specimen.

These observations serve to prove that two factors are absolutely essential to the introduction of filarial disease into any country; viz., a filaria-infected person, and filaria-breeding mosquitoes.

There is reason to believe that the disease has been introduced comparatively recently into certain

---

(1) "China Customs Medical Reports". No.21
(2) "Lancet", vol.i, 1887, p.733.

countries. (1)In the island of Barbadoes, for instance, the disease was unknown until the advent of an individual suffering from elephantiasis; since which period elephantoid affections have become endemic. Dr Bancroft believes that the disease has been introduced into Queensland by Chinese coolies from Amoy.

(2)It has been stated that elephantiasis is not uncommon in the south of Ireland, and (3) Dr Stephen Mackenzie has related the case of a patient who came from the county of Fermanagh; but there is no evidence to show whether these cases were the result of filarial disease or not.

It must not be forgotten that any cause, which is capable of producing obstruction of a portion of the lymphatic system may result in symptoms similar to those produced by filarial disease. (4)Meade, (5) Sydney Jones, (6) Bryant and others have related cases of the disease occurring in persons who had never been out of England, and (7) Mr Hutchinson has described others, to which I have already alluded, of recurring erysipelas associated with elephantiasis. None of these apparently were the result of filarial disease.

---

(1) I regret I am unable to give the authority for the statement.
(2) "Dublin Hospital Reports", vol.iv.p.54
(3) "Lancet", vol.ii, 1880, p.619.
(4) "Lancet", vol.ii, 1861, p.185.
(5) "Lancet", vol.i, 1875.
(6) "Lancet", vol.ii, 1880, p.207
(7) "Medical Times and Gazette", vol.i, 1883.p.4

Influence of race.

Almost all the older writers on elephantiasis believed that the dark races were more susceptible to the disease than the white races; but it is extremely doubtful if this is the case. It is true that in the countries where the disease is endemic, the proportion of persons affected is much greater among the blacks than amongst the whites, but it has to be borne in mind that the habits of the former render them much more liable to the disease than the latter. The majority of the white population being more civilised, are more careful regarding the purity of their drinking water, than the natives, who are proverbially careless in this respect. In India, although it is comparatively rare to meet with Europeans affected with the disease, yet such cases are from time to time recorded.(1) Eurasians are proportionately more liable to the disease than pure Europeans, but not so much so as natives. (2) Drs Patterson and Hall of Bahia examined the blood of 309 persons in that place, and found the following proportions affected with filariae. Of whites, 1 in 26; of blacks, 1 in 10¼; of the mixed race, 1 in 9.

---

(1) "Indian Medical Gazette", Nov. 1873.
(2) "Veterinarian", June 1879.

(1) Dr Saville states that in the Society Islands, out of a total of 13 European and American residents, 11 were affected with elephantiasis.

Taking all these facts into consideration, together with our knowledge of the pathology of the disease, I do not think we are justified in saying that the black races are more susceptible to the disease than the white races. On the other hand, owing to the nature of their habits, they are much more liable to the disease than the white races.

Influence of sex.

(2)Drs Tilbury Fox and Farquhar in reviewing their inquiries into this subject, came to the conclusion that both sexes were equally liable to the disease, and (3) Manson's observations in China inclined him to a similar opinion. In Brazil, according to (4) Drs Patterson and Hall, 1 out of 11½ males are affected with filariae and 1 out of 13 females. On the other hand, Sir Joseph Fayrer, and Dr Richards, as well as others, state that in India

---

(1) "On certain endemic skin and other diseases of India, etc." Tilbury Fox and Farquhar.
(2) Idem.
(3) "China Customs Medical Reports", No.xiv.
(4) Patterson and Hall, op: cit:

the female sex is less liable than the male. Males are affected to females, as 3 to 1 according to Fayrer, and 3 to 2 according to Richards. It must be remembered however, that, throughout the East women are much less ready than men to seek medical aid, more especially ~~when~~ as is so frequently the case in this disease, ~~when~~ the genital organs are affected. These facts render it impossible to estimate, with any accuracy, the relative liability of the sexes in India. We know that women in India are very frequently affected with elephantiasis of the legs or of the labia.

Influence of age.

Elephantiasis is most frequent between the ages of 20 and 50. It is rare below the age of 15, but cases have been reported as occurring at the age of 10, and under.

The following table given by (1)Waring, corresponds very closely with those prepared by other observers, such as (2)Richards, (3)Mohideen Sheriff, and (4)Patterson and Hall.

---

(1) "Indian Annals of Medical Science", vol.v.
(2) "On certain endemic skin and other diseases,etc." T. Fox and Farquhar.
(3) Idem.
(4) Op: cit:

Age table of 945 cases of elephantiasis. (Waring)

Age	Number of cases	Per-centage
From 5 to 10 years	2	.21
" 11 " 15 "	12	1.27
" 16 " 20 "	54	5.71
" 21 " 25 "	71	7.61
" 26 " 30 "	117	12.38
" 31 " 35 "	98	10.37
" 36 " 40 "	156	16.49
" 41 " 45 "	110	11.55
" 46 " 50 "	112	11.76
" 51 " 55 "	70	7.35
" 56 " 60 "	66	6.98
" 61 " 65 "	22	2.32
" 66 " 70 "	10	1.05
Above 70 "	10	1.05
Doubtful age	35	3.67
	945	100

It would appear, according to Manson, that the liability to filariae gradually increases with age. This he explains by the fact that the parent filaria lives for a long time, "so that old age not only has its own liability to fresh infection, but possibly inherits the worms of youth and middle age." (1)

---

(1) Fil: Sang: Hom:, p.74.

The following is Manson's table showing the progressive liability to filariae.

Decennial period	Number examined	Filariae found in	Percentage of total cases of filaria	Proportion affected
10 to 20	35	2	3.22	1 in 17.5
20 " 30	219	17	27.42	1 " 12.9
30 " 40	177	16	25.81	1 " 11.1
40 " 50	133	12	19.35	1 " 11.1
50 " 60	70	8	12.91	1 " 8.8
60 " 70	25	4	6.45	1 " 6.25
Over 70	9	3	4.84	1 " 3
Not ascertained	2	—	—	—
Total	670	62	100	- -

Influence of occupation.

The occupation of the individual does not appear to have any manifest influence as regards liability to the disease. It is true that (1)Waring, Richards, and others were of opinion that agriculturists and coolies were more liable than other classes, but their conclusions were based upon fallacy, as they did not calculate the proportion affected of each class separately. Manson's observations led him

(1) Op: cit:

to conclude that the occupation of the individual did not influence the liability to the disease, except perhaps, that boatmen, fishermen, and sailors were less liable to the disease than other classes. The above mentioned Indian writers share Manson's opinion regarding the lesser liability of fishermen, and boatmen. Out of 13 individuals upon whom I have operated for elephantiasis of the scrotum, 3 were merchants, 2 were shopmen, 1 was a goldsmith, 1 a clerk, 1 a priest, 1 a draughtsman, 1 a coachman, 1 a cook, 1 a baker, and 1 a schoolboy.

Symptoms.

The disease is ushered in by swelling and pain or uneasiness in the lymphatic glands, either of the groin or axilla, and these symptoms are followed in a few hours by violent fever. The lymphatic disturbance is not always well marked, and may be overlooked. Some observers go so far as to say that fever is the primary symptom. Careful examination however, will always detect symptoms of glandular disturbance, and even Richards, who wrote before the true pathology of the disease was understood, stated that, (1) "so commonly does the lymphatic disturbance

---

(1) "On certain endemic skin and other diseases, etc". T. Fox and Farquhar.

precede the paroxysms of fever that many patients regard the swelling of the glands of the axilla or groin as a premonitory symptom of an attack."

The febrile symptoms, which are usually of a violent nature, are ushered in by headache, nausea or vomiting, and often by rigors; and, in cases where the obstruction is situated high up in the lymphatic system, there is pain in the loins. The constitutional disturbance is symptomatic of the glandular inflammation which precedes it. Coincident with the advent of fever, inflammation of the tissues, drained by the affected glands, sets in. There is pain, redness, and oedematous swelling, the nature of which has already been described. The fever is continuous, and, together with the other symptoms of constitutional disturbance, lasts for three or four days. Cessation of fever is followed by gradual abatement of the local disturbance, and, after a time, the tissues appear to recover their normal condition. Immediately after recovery from the primary attack, there is often no manifest sign of the damage which has been done to the lymphatics; excepting some enlargement of the glands. After an interval of variable extent, the patient is again attacked with a train of similar symptoms, followed

perhaps by apparent recovery of health. Such attacks however, continue to repeat themselves at intervals of variable extent, and although at first they appear to be followed by recovery, yet after a time it is noticed that the subsidence of the local swelling is only partial, and that each successive attack involves a slight increase in the bulk of the affected tissues. In other cases, attacks of fever and inflammation are not repeated for long periods; but in all cases, whether the attacks are frequent or not, there is gradual enlargement of the affected part. According to (1) Richards 5½ per cent of cases of elephantiasis do not suffer from recurrent attacks of fever, and (2) Wong of Canton met with many cases in which there was no history of febrile attacks.

We have already seen that the condition of malnutrition of the tissues, which results from the damage to the lymphatics, renders the part extremely liable to inflammation, and hence we can easily understand how chills, over exertion, or injuries may, and do, so frequently result in such attacks. In my opinion attacks of ague are frequently the exciting

---

(1) "On certain endemic skin and other diseases, etc" T. Fox and Farquhar.

(2) Idem.

cause of attacks of lymphangitis, and this serves to explain the apparent periodicity of the disease in some cases, and the belief of many of the older writers in the malarial origin of the disease. The inaccuracy of the statements of Orientals, their belief in the periodicity of all fevers, and their ideas of lunar influence on the body, no doubt also account, in a measure, for the old ideas of the periodicity of the attacks.

During the intervals the patients enjoy good health, and their only complaint is of the inconvenience arising from the presence of the tumour, when the latter becomes of large size. When the lower limbs are affected, and grow large and unwieldy, walking becomes proportionately difficult and laborious, and extensive hypertrophy of the scrotum interferes, to a still greater extent, with the power of locomotion.

Occasionally the parts affected with elephantiasis are attacked by a sloughing process or gangrene; threatening the life of the patient and necessitating immediate interference.

Cases of acute inflammation followed by sloughing of the scrotum, threatening the life of patients otherwise strong and healthy, are not infrequent in

India, and such cases are, in my opinion, frequently due to filarial obstruction of the lymphatics. The symptoms and progress of cases of lymphatic varix resemble in most respects those of elephantiasis. They differ only in the nature of the permanent changes which take place in the tissues of the part, and in the fact that in cases of lymphatic varix, each attack of fever and local disturbance is accompanied by discharge of lymph from the surface. The fluid which is poured out is, as we have seen, either clear, milky, or sanguineous, and the discharge continues in most cases for three or four days. In some cases, however, the discharge becomes so profuse and continuous as to exhaust the patient, and endanger life, and in such cases it becomes necessary to operate at once.

In some cases of elephantoid disease, the febrile attacks become so frequent as to exhaust the patient and necessitate surgical interference.

According to (1) Richards and (2) Day, when women are affected with elephantoid disease the uterine functions are interfered with, and abortion becomes frequent. The same authors further state, that

---

(1) Op: cit:
(2) Op: cit:

when males are affected, the procreative powers become diminished or anulled. (1) Sir Joseph Fayrer, however, does not share their opinion regarding the effect upon males.

Parts affected with elephantoid disease.

There is great discrepancy of opinion regarding the relative frequency of elephantiasis of the scrotum and elephantiasis of the limbs. (2) Waring states that the lower extremities are affected in 98 per cent of cases, and that in only 4 out of 945 cases collected by himself was the scrotum affected. According to (3) Richards, the lower extremities are affected in the ratio of 85 per cent, and the scrotum in the ratio of 4½ per cent. (4) Day gives similar figures. (5) Mohideen Sherif states that the lower extremities are affected in the ratio of 71 per cent, and the scrotum in the ratio of 28 per cent.

In considering these figures it must be borne in mind that a certain amount of shame is attached to

---

(1) "Tropical dysentery", p.258.
(2) Op: cit:
(3) Op: cit:
(4) Madras Quarterly Journal of Medical Science, vol.i p.37
(5) "On certain endemic skin and other diseases, etc".

the fact of being affected with scrotal disease, and that there is an idea among natives that the latter is connected with venereal disease. The experience of the Presidency Hospitals in India is quite opposed to that of some of the observers whom I have quoted, and Palmer of the Calcutta Hospital states that 80 per cent of the cases he met with were affected with scrotal disease. These figures, however, do not represent, any more than the others, the true proportions; because most of the patients who resort to the Presidency Hospitals, do so for the express purpose of undergoing amputation of the scrotum. In my own practice in the General Hospital of Madras, the majority of cases of the disease which came under my notice, are cases in which the scrotum is affected; the patients having come to Hospital for the express purpose of having the scrotum removed. Such patients, suffering from elephantiasis of the limbs, as I do come across, have usually resorted to Hospital on account of some other disease, or on account of injuries.

The figures given by Mohideen Sherif are probably nearer the truth than any of the others, but even in his case I think the relative frequency of elephantiasis of the limbs is overestimated.

All observers are agreed as to the comparative infrequency with which the disease affects the upper extremities.

When the lower limbs are affected, the disease is usually limited to the foot and leg, and, in like manner, when the disease affects the upper extremity, it is usually limited to the hand and forearm. This is probably due to the fact that some of the lymphatics of the thigh do not enter the inguinal glands (1) but accompany the obturator, ischial, and gluteal vessels into the pelvis. A similar distribution of lymphatics probably exists in the upper limbs.

Lymphatic varix is much less frequent than elephantiasis proper. According to (2) M^cLeod, only 3 per cent of cases of scrotal disease suffer from 'lymph-scrotum'.

The size to which scrotal tumours attain is sometimes enormous. Sir Joseph Fayrer removed a tumour weighing 110 lbs, and (3) Mr Partridge of Calcutta removed one weighing 111 lbs. Mr (4) Cooper is

---

(1) Curnow, op: cit:
(2) "Operative Surgery".
(3) "Medical Times and Gazette", vol.i, 1880, p.660.
(4) "Medical Times and Gazette", vol.i, 1884, p.177

Norman Chevers.

said to have removed a tumour weighing 224 lbs.

Diagnosis.

The initial attack of the disease may easily be mistaken for one of glandular inflammation and erysipelas, such as might result from a poisoned wound. In a country where elephantoid disease is endemic, and when there has not been any wound, filarial disease may be suspected; and if the embryo filariae are found in the blood, there is still less doubt as to the nature of the case. The absence of filariae from the blood does not, on the other hand, exclude the diagnosis of elephantoid disease; because the embryos may escape observation, or may be temporarily absent from the blood. I have already stated that the examination of the blood in such cases must not only be conducted at night, but also that it must be systematic and prolonged. It must moreover be borne in mind that the febrile state interferes with filarial periodicity and lessens the number of filariae in the blood at any one time.

The disease may be distinguished from malarial fever by the symptoms of primary lymphatic disturbance and by the absence of intermissions or remissions,

anaemia, dropsy, enlarged spleen or cachexia. (Richards)

When once the disease is fully established, there is no difficulty about the diagnosis, either of elephantiasis, or lymph-scrotum.

Prognosis.

Excepting the liability to attacks of fever and inflammation, the subjects of elephantoid disease enjoy good health as a rule.

The following table, prepared by (1)Waring, serves to show how long such patients may live.

Duration of disease	Number of cases	Percentage
Under 1 year	44	4.66
From 1 to 5 years	197	20.85
" 6 " 10 "	196	20.74
" 11 " 15 "	136	14.39
" 16 " 20 "	126	13.33
" 21 " 25 "	79	8.36
" 26 " 30 "	71	7.52
" 31 " 35 "	30	3.17
" 36 " 40 "	23	2.43
" 41 " 45 "	11	1.16
" 46 " 50 "	2	.20
" 51 " 55 "	2	.20
Doubtful	28	2.96
	945	100

(1) "Indian Annals of Medical Science", vol.v, p.1

The dangers to which the patients are liable, I have already recounted, when treating of the symptoms of the disease. Inguinal hernia which sometimes exists in cases of elephantiasis of the scrotum, is a serious complication, and, as we shall see, affects the question of operation

Treatment.

Elephantoid disease is one of those affections which it is theoretically possible to stamp out. Were it possible to secure a water supply, either originally unimpregnated with immature filariae, or so purified by filtration or boiling as to insure the destruction of these parasites, the disease would perforce disappear. Putting aside such possibilities, we have to admit that the ignorance, as well as the poverty of the natives, must prevent any such happy consummation, in Eastern countries, for a long time to come. Much, however, may and has been done, in this direction, in the larger towns of India. In Madras, for instance, since the introduction, in 1873, of a new water supply brought from a distant reservoir, there has been a very marked diminution of 'Guinea worm'. There is every reason to hope that the 'filariaesanguinis hominis', like the filaria Median-

ensis', may become rare in that city; and there is a general impression that already elephantiasis is becoming less frequent.

When once an individual has become the victim of the parasite, it is questionable whether it is possible to do anything to relieve him of his unwelcome guest. It is possible that the animal might be destroyed by means of drugs administered to the host, but the first effect would, more than probably, be to produce abortion and embolism of the lymphatic glands; and thus bring about the very catastrophe which we wish to avoid. When once this catastrophe has occurred and the lymphatics have become damaged, we cannot hope to do more than to relieve symptoms when they arise, and remove, when necessary, such outgrowths as result from the disease.

General treatment

The subjects of elephantoid disease must, as far as possible, avoid all those contingencies which are liable to produce inflammatory attacks; such as over-exertion, exposure to extremes of temperature, and chills.

Whenever attacks of inflammation arise, the treatment must be conducted on general principles.

The patient must rest in bed and the inflamed part must, as far as possible, be elevated, and cold or hot applications used in accordance with circumstances. After inflammation has commenced to subside, the part must be carefully bandaged and kept in an elevated position; and the longer the patient can be induced to continue this treatment, the less rapid will be the progress of the hypertrophic changes.

The nature of the treatment of the disease in its later stages depends upon the particular part of the body which is affected, and hence it is necessary to discuss separately the treatment of elephantiasis of the limbs and that of the scrotum.

Elephantiasis of the limbs.

I propose to deal first with the question of the propriety of ligaturing the main artery of the limb in these cases.

This operation is still countenanced by some surgical authorities, is still treated of in some text books as a legitimate one, and is still, I regret to say, occasionally put in practice. In my opinion the operation is totally unjustifiable.

It was first proposed and practised by (1)

(1) "Medical Times and Gazette", vol.ii, 1877, p.470 Jamieson.

Carnochan of New York in 1851, and has, since that period, been performed by a great number of surgeons; notably by Butcher, Bryant, Fayrer, Richards, Bochard Baum and Simon.

The following are the more important reasons which have led to its condemnation, and they demonstrate so unmistakeably the impropriety of under taking the operation, that it is a matter for wonder that any surgeons can still be found to countenance it.

1. The disease, under ordinary circumstances, not being one which threatens the life of the patient, nor materially affects his health, the undertaking of any operation which seriously endangers the former, is not justifiable. In treating of the prognosis of the disease, it was pointed out that patients affected with elephantiasis might live to an indefinite age, and that their general health does not usually suffer. In those exceptional instances, when life is threatened by severe inflammation or gangrene of the limb, amputation is the only operation likely to save the patient's life.

2. To ligature the main artery of an elephantoid limb — a limb which is liable to attacks of violent inflammation and serious disturbances of nu-

trition, as the result of even trivial causes-is to perform an operation fraught with very considerable danger to the life of the patient. When we consider the condition of the tissues in these cases, the great and constant disturbance of nutrition, and the fact that slight injuries are liable to produce violent inflammation, it is difficult to believe that the operation is not fraught with great danger. Most of the statistics of the operation that have been published are unfortunately very unsatisfactory and vague regarding the mortality.

Erichsen, however, quotes Eppner to the effect that 49 cases were followed by 5 deaths; a mortality of 10 per cent. Bryant operated 4 times with 1 death; (1)Sir Joseph Fayrer 3 times with 1 death, and (2) Jamieson records a fatal case. These figures serve to show that the operation is frequently followed by a fatal result.

(3) The operation in a great number of cases fails to afford any relief. Jamieson collected reports of 28 cases in(3) the majority of which the result was negative; in a few there was marked dimi-

---

(1) "Medical Times and Gazette", vol.i,1870, p.577.
(2) do do do do vol.ii,1877,p.470.
(3) Idem.

nution of the swelling; and in only one or two cases apparent cure. (1) Buchanan collected 12 cases, 4 of whom were not benefited by the operation. (2) Fischer reports 21 cases, 10 of whom were not benefited; and (3) Wernher 32 cases, 16 of whom were unsuccessful. According to the best of these statistics (Buchanan's) 4 out of 12 cases were not in any way benefited.

4. When the operation does result in relief of the symptoms, or in apparent cure of the disease, the beneficial effects are only temporary, and the swelling sooner or later recurs. In most of the records that have been published there is no attempt to show whether the cure was permanent or not, and there is every reason to believe that in many, if not in all, cases of apparent cure, the disease sooner or later re-appears. Of the 31 cases reported by (4) Eppner, 9 were known to have relapsed; and out of 32 cases reported by Wernher, permanent relief was obtained in only 3. (5) Buchanan operated upon a case the result of which led him to speak warmly of the advantages of operation and to recommend its adoption

---

(1) "Biennial Retrospect of Medicine and Surgery", vol.67-68.
(2) "Rankin's Abstract", vol.i, 1870, p.117.
(3) "Ashurst's Encyclopaedia of Surgery".
(4) Op: cit:
(5) Op: cit:

in spite of the unfavourable criticisms of Syme and others; at the same time he pointed out the imperfection of our information as to the permanence of such cures. Shortly afterwards, his own patient, whom he thought he had cured, was seized with fresh attacks of inflammation, and the limb returned to its former size. He concludes "in this case therefore the success obtained was only temporary, and a knowledge of this fact must necessarily induce us to look with some suspicion upon other published cases, in which we have no information as to the state of the patient, long after the operation."

5. The beneficial effects attributed to the operation, are in reality the result of the associated treatment, such as rest and bandaging of the limb; and can be brought about equally well by the latter means alone.(1) A case, related by a medical man in South Australia, illustrates very clearly the fact that the beneficial effects attributed to the operation are the result of the associated treatment, rather than of the operation itself. In this case the patient suffered from elephantiasis of both lower limbs, on one of which the operation of ligature was performed. Seven weeks after operation the limb

---

(1) "Lancet", vol.i, 1879, p.44

which had been operated upon had diminished in circumference, at the calf by 4 inches, and at the ankle by 5¼ inches; whereas the limb which had not been operated upon had diminished in girth, at the calf by 3½ inches, and at the ankle by 7 inches. The limb therefore which had not been operated upon improved to a greater extent than the other; thereby proving that the operation at any rate, was not the cause of the beneficial result. The surgeon who narrates the case, believes that digitalis and ergot, both of which were administered to the patient, were the cause of the improvement. Whether these drugs had any share in producing the beneficial results, it is of course impossible to say; but on the other hand, all surgeons who have had much experience in the treatment of the disease, are aware that similar benefit can be obtained by keeping the patient at complete rest; and elevating and bandaging the limb.

6. Our knowledge of the pathology of the disease does not lead us to expect any permanent benefit from such an operation. The failure of the operation to afford any permanent relief is only what we should expect considering the nature and pathology of the disease. Neither this operation, nor any other, can restore the damaged lymphatics, nor re-establish the normal circulation of the lymph.

An unbiassed consideration of all the facts which I have enumerated cannot but convince every surgeon of the impropriety of attempting this operation, and therefore it is very necessary that these facts should be widely known, and that the practice should be decisively condemned by all surgical authorities.

All that we can hope to do in elephantiasis, is to prevent, as far as possible, the outflow of lymph, and to promote absorption by means of rest, elevation of the limb, and bandaging. The longer the patient can be induced to undergo this method of treatment, the greater the benefit that will result. As soon as the treatment is left off, there will be a gradual return of swelling, which will be aggravated by further attacks of inflammation.

(1) Aranjo of Brazil treated a case of elephantiasis with electricity, obtaining a satisfactory result; but states that the treatment was rendered more efficacious by elevating and bandaging the limb.

(2) Dr Dowse used a similar method of treatment with benefit. It is quite possible that electricity may aid in removing the hypertrophy for the time being, but it cannot possible cure the disease.

---

(1) London Medical Record, vol.viii, p.185
(2) Lancet, vol.ii, 1880, p.619

(1) Mercury has been used extensively, both externally and internally, with varying success. When benefit has resulted, the treatment has usually been associated with rest and bandaging. A very interesting case was published by (2) Mr Bentley, in which the limb was elevated, fomented and rubbed with strong mercurial ointment; and iodide of potassium and chlorate of potash were administered internally. The treatment lasted three months, and resulted in complete disappearance of the swelling, and the patient is said to have remained well for three years afterwards.

It is right to mention here that several Indian authorities believe that the disease is cured by change of climate, but, so far as I know, no cases have been published in proof of these statements. When the health of the patient is harassed by constantly recurring attacks of inflammation and fever, the limb must be amputated.

Elephantiasis of the scrotum and 'lymph-scrotum'

The remarks which have been made, regarding the treatment of elephantiasis of the limbs, apply, in a great measure, to the treatment of scrotal disease.

---

(1) Clin: and Path: Observ: in India. Fayrer
Madras Quarterly Journal, Day, etc.
(2) Lancet, vol.i, 1878, p.784

Complete rest, combined with elevation of the part, and equable pressure applied by means of bandages, will reduce the swelling for a time, but will not effect a permanent cure. When once the tumour has reached such a size as to interfere with the power of locomotion, or to be a great deformity, it is better that the diseased mass should be removed, and a permanent cure thus established. In those cases in which attacks of inflammation and fever are constantly recurring, and thereby seriously affecting the patient's health, amputation of the scrotum must be carried out without delay. Similar principles must guide our treatment of 'lymph-scrotum'. When the discharge of lymph is so copious or so constant as to seriously affect the patient's health, there must be no delay in removing the scrotum.

The operation for removal of elephantiasis of the scrotum, or 'lymph-scrotum', was, I believe, first attempted by(1) Mr Key of Guy's Hospital, but his patient succumbed to haemorrhage. The first successful operation was performed in 1831 by (2)Brett of Calcutta, who removed the scrotal tumour, and at the same time preserved the genital organs intact.

---

(1) "Medical Times and Gazette", vol.i,1884, p.177
Norman Chevers.

(2) Idem, and 'Lancet',vol.i,1846,p.241, and Lancet, vol,ii,1846,p.36

Brett operated by means of flaps, and a similar method was employed by (1)Bascombe, but it was soon found that flaps were not only unnecessary, but also disadvantageous, for the disease always reappeared in the tissues that were left behind.

The danger of haemorrhage which was the great difficulty in these early operations, was first overcome by Sir Joseph Fayrer who employed a cord to compress the neck of the tumour during the operation. A still further advance was made in 1874, when Mr (2) Partridge of Calcutta, first introduced elastic compression as a means of controlling haemorrhage.

(3)The first statistics published regarding this operation, were those of the General Hospital of Calcutta, from 1859 to 1871, recorded by Sir Joseph Fayrer. This report included 193 operations, with 35 deaths, giving a mortality of 18.2 per cent. Of the fatal cases, 15 died from septic poisoning; 6 from tetanus; 1 from gangrene; 7 from exhaustion; and 4 from other causes, such as embolism and diarrhoea.

A later report of the cases occurring in the

---

(1) "Lancet", vol.i, 1846, Bascombe.
(2) "Medical Times and Gazette", vol.1880, p.660
(3) "Transactions of the Pathological Society" vol.xxx Sir J. Fayrer.

Calcutta Hospital is given by McLeod,[1] and consists of 129 operations with 23 deaths, showing a mortality of 17.7 per cent. Of the fatal cases; 6 died from septic poisoning; 9 from tetanus; 1 from gangrene; 4 from exhaustion, and 3 from other causes. The records of the General Hospital of Madras, for the years 1870 to 1884, show a series of 115 operations with 17 deaths, giving a mortality of 14.78 per cent.

The comparatively high mortality in the Calcutta Hospital appears to have been chiefly the result of septicaemia and tetanus, and is explained, I believe, in a great measure, by the unsuitability of the building to the requirements of a hospital, and the want of efficient ventilation. Moreover, the first series of cases occurred in the days before antiseptics had come into general use; and the high mortality cannot be wondered at when we read, that "the foetor[2] of the discharges, which during the hot weather, with the thermometer at 91° in the shade, decompose very rapidly, cause the patient and his neighbours much annoyance." If we exclude the deaths from septicaemia and tetanus, the mortality in the first series of operations would be reduced to 7.2 per cent, and in the second series to 6.1 per cent.

---

(1) "Operative Surgery", McLeod.
(2) "Clinical Surgery", Fayrer. p.310

My own cases, in the General Hospital of Madras have been 13, all of whom recovered with the exception of one man, who was removed from hospital by his friends, and died from diarrhoea a month after the operation. Assuming that the death of this patient was the result of the operation, the mortality of this series of cases was 7.3 per cent. Of course this series of cases is too small to be in itself of much value, but the experience gathered from these cases joined to a consideration of the above statistics, lead me to believe that the mortality of this operation will, in course of time, be reduced to a much smaller figure. Under favourable circumstances septicaemia should be very rare indeed, even in Indian hospitals; and although tetanus is very common in that country, it seldom, if ever, follows wounds or operations, as long as the latter remain in an aseptic condition. Such, at least, is my experience.

In deciding upon the advisability of operating in cases of elephantiasis of the scrotum or lymph-scrotum, the surgeon is guided by those general rules which are applicable to all operations of a major degree. Visceral disease, more especially disease of the kidneys, of necessity forbids operation, as do also enfeebled conditions of the system generally,

unless arising from the disease itself. The presence of an inguinal hernia does not, according to McLeod forbid the operation. The only cases in which I have met with this complication, have been ones in which the hernia was large, of old standing, and irreducible, and such cases I should always decline to operate upon, excepting as a matter of expediency. The danger of shock is proportioned to the size of the tumour, and is only serious in cases of extremely large growths. The operation in itself is quite devoid of danger, and if such cases, as I have mentioned, be excluded, a favourable issue may be confidenily anticipated.

In the measures adopted preparatory to the operation, the most important are those which refer to the cleansing of the parts to be operated upon. At least twenty four hours before the operation, the parts must be very carefully shaved, well scrubbed with soap and warm water, and then enveloped in cloths saturated with an antiseptic lotion. Immediately before the operation these cloths are removed and the parts scrubbed with spirits of turpentine.

Means adopted for preventing haemorrhage.

Some surgeons are in the habit of completely

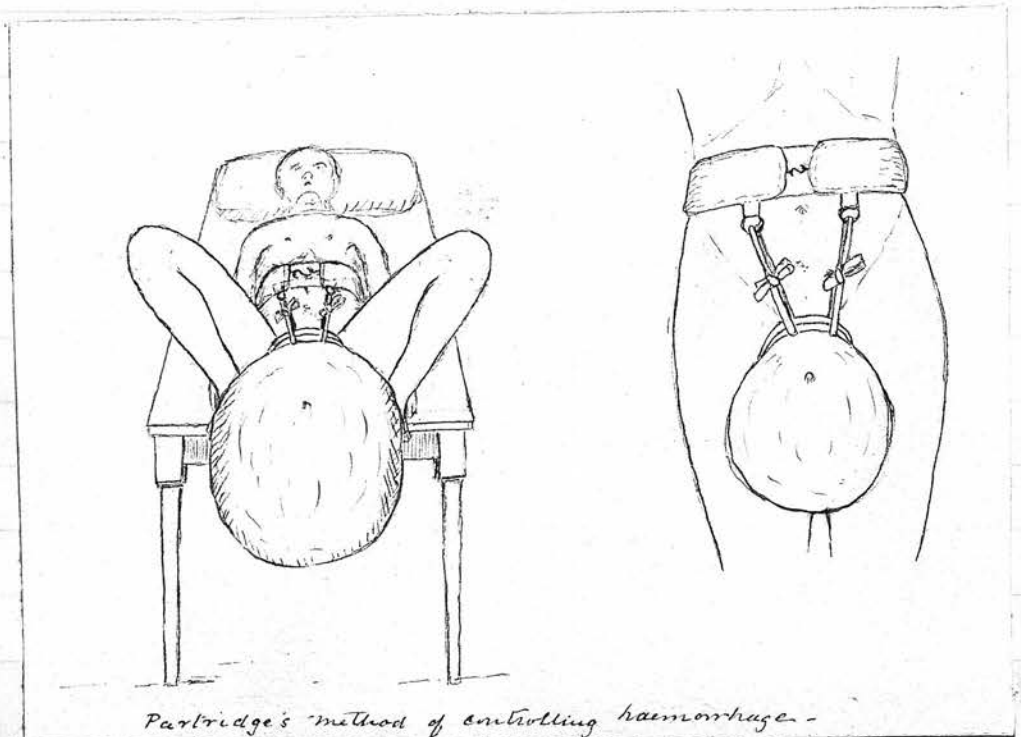
emptying the tumour of blood by means of Esmarch's bandage. For my own part I cannot believe that the sudden addition of such a large quantity of blood to the general circulation, and the corresponding increase of blood pressure, are conditions devoid of danger, and I always content myself with applying only such an amount of pressure, as is sufficient to empty the large veins of the tumour. Whether the tumour be completely drained of blood, or not, it is necessary to restrain haemorrhage during the operation, by constricting the neck of the tumour by means of an elastic cord. This may be done in accordance with the plan adopted by Mr Partridge or by a method employed by Mr McLeod.

(1) The former method, which is, I believe, the one more generally in use in India, consists in encircling the neck of the tumour by means of an elastic cord. Beneath this elastic cord are passed four tapes, two in front and two behind; and these, in their turn, are attached to the four rings of a belt which encircles the patient's waist. By drawing on these tapes and securing them tightly, the elastic cord is prevented from slipping down and off the neck

---

(1) 'Medical Times and Gazette", vol.i, 1880, p.660

of the tumour. Dr McLeod objects to this method that the belt is apt to impede breathing, and that the elastic cord is apt to slip off the neck of the tumour, after the latter has been removed. The first of these objections is certainly of importance, as, although under ordinary circumstances it does not give rise to any inconvenience, particular instances might occur in which it might prove a source of danger, and necessitate the removal of the belt during the operation. On the other hand, Dr McLeod's own method is open to a similar objection, although in a less degree, because considerable pressure upon the abdomen is caused by the elastic cord. As regards the second of these objections, there is no fear of the cord slipping, if the apparatus be properly applied. The accompanying drawings serve to illustrate Partridge's method of controlling haemorrhage.

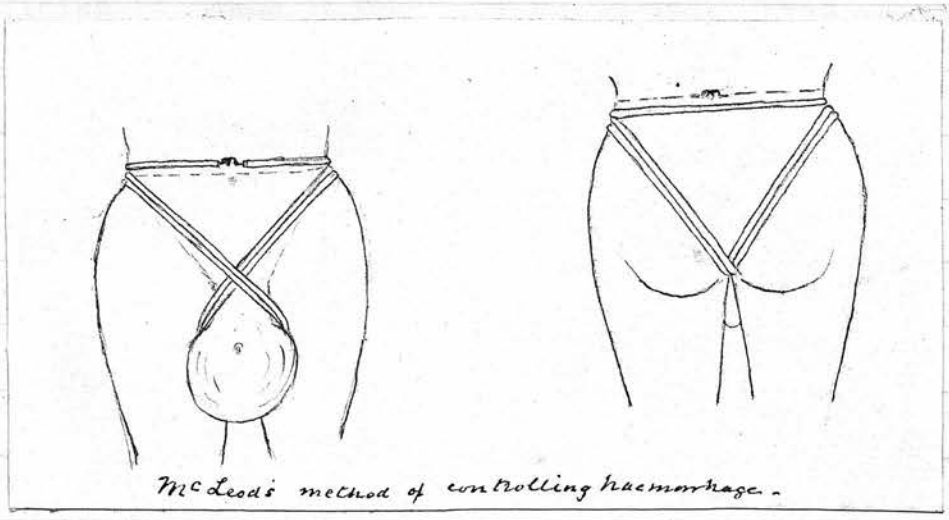


Partridge's method of controlling haemorrhage.

(1)McLeod's method, of which I have no personal experience, I describe in his own words. It is commenced "by placing the middle of the cord over the lumbar region; this gives two ends. I take the right end and pass it round the left side of the neck of the tumour, crossing the pubis. Having encircled the neck on the left side, the loop crosses in front of the anus to the right, lodges in the cleft of the nates, and is brought round a second time over the crest of the ilium, and again carries round the neck of the tumour, and ~~the same manoeuvre is carried~~ above the crest of the ilium; the same manoeuvre is carried out on the opposite side with the other end of the cord, and the two ends are finally looped over the abdomen. The neck of the tumour is thus clasped by four tight cords of india-rubber crossing each other over the pubis, and in front of the anus; it is compressed by an oval elastic loop which presses vertically as well as laterally, and has therefore less tendency to slip than a single ring or loop. The main pressure of the stretched cord is brought to bear on the crests of the iliac bones, and there is no pressure on the abdomen except that which results from the final loop." the accompanying drawings illustrating this method, are taken from McLeod's work.

---

(1) "Operative Surgery". McLeod.



McLeod's method of controlling haemorrhage.

The circulation having been controlled by either of these methods, the patient is placed in the lithotomy position, and the operation commenced by introducing a director into the orifice of the prepuce, slitting up the latter with a sharp pointed bistoury, seizing the glans, and by continuing the primary incision upwards towards the pubis, shelling out the penis. Two parallel vertical incisions are then made into the tumour, one on each side over the line of the cords and testicles, and are deepened until the latter are reached. The testicles are then seized and shelled out along with the cords. If the testicles are affected with hydrocele, care should be taken not to open the sac at this stage of the operation, as otherwise it will not be so easy to isolate the cord and testicle. The upper ends of the

two vertical incisions are now joined to the primary incision by means of two horizontal cuts. The penis, testicles, and spermatic cords now being held up over the abdomen by an assistant, the whole mass of diseased tissue is removed by a sweeping incision carried within half an inch of the elastic compressor. If hydroceles are present, they should now be dealt with by opening the sac, and after all the fluid has escaped, cutting off the whole of the parietal portion of the tunica vaginalis, with the exception of a small margin, ¼ of an inch in breadth.

The next procedure is to take up and tie, or twist, all such arteries as can be seen. These will chiefly be found in the centre of the perinæum, and between the root of the penis and the pubis (internal pudic branches); and also at the upper margin of the wound (external pudic branches). After these vessels have been secured the elastic cord may be removed, and the surface of the wound compressed with sponges, by assistants, until all the remaining vessels have been seized by means of forceps. The vessels may then be tied at leisure, or twisted.

If any elephantoid tissue remain at the edges of the wound it should now be pared away by means of scissors, and care must be taken to remove the whole

of the mucous membrane of the prepuce, as if any portion be left behind, it will ultimately become hypertrophied, and necessitate another operation.

The final stage of the operation consists in fixing the testicles in position. In the early days of this operation, surgeons were in the habit of retaining flaps of, what appeared to be, healthy skin, and by means of these covering in the testicles. It was soon found however, that such flaps of skin became subsequently diseased, and the operation by means of flaps was abandoned. In spite of these facts, this method of operating has from time to time been revived, showing that the uselessness of such attempts is not as fully recognised as it should be. The impropriety of any attempt to retain flaps of skin can not be too firmly insisted upon, for as long as any of the skin or subdermic tissue, which is drained by the damaged lymphatic glands, is left behind, such tissue must subsequently become diseased. Any attempt to use skin to cover in the testicles must end in failure. The method of fixing the testicles, which I have been led to adopt, consists in uniting the fringe of the tunica vaginalis of each organ to the edges of the wound, by means of silk sutures. The two testicles are united to one another in the median

line, in a similar manner, by means of sutures passed through the fringe of the tunica vaginalis.

Dr McLeod's method of fixing the testicles, consists in dissecting up the deep layer of the superficial fascia of the perinaeum, and thus making "pockets" within which the testicles are placed.

This procedure has, however, always appeared to me to prolong and complicate the operation, without producing any compensating advantages over the simpler method which I have described.

As regards the dressing of the wound, there is one point that I consider of very great importance, and that is, that a piece, either of Lister's "protective", or of ordinary oil-silk, should be placed in immediate contact with the wound.

Unless this precaution be adopted, the dressings become so incorporated with the surface of the wound as to render the subsequent changing of the former not only extremely painful, but also, by tearing up the granulations, to cause haemorrhage, and subject the patient to increased risk of septicaemia. If either of these substances be placed next the wound, the dressings are removed easily, and without causing pain or haemorrhage. It may seem unnecessary, in these days, to draw attention to such a point, but I be-

lieve the necessity, for such precautions, is not as widely recognised as it should be; and it certainly was the practice, only a few years ago, of some surgeons, to dress these wounds without the interposition of any protective medium. In such cases, in order to avoid the difficulties to which I have alluded, the dressings were not changed for three or four days, until suppuration had been established. It is almost needless to add, that, with a temperature bordering upon the nineties, the smell from these wounds became intolerable, and that septic disease or tetanus were not infrequently the result.

The nature of the dressings employed, provided they be antiseptic, absorbent, and sufficiently often changed, is immaterial.

A considerable time elapses before the whole wound is covered with granulations, but as soon as this process is satisfactorily established, skin-grafting must be resorted to. Owing to the movements involved in the acts of micturition and defæcation, and the consequent liability to disturbance of the dressings, skin-grafting is carried on under considerable difficulties.

One of the most important points at this stage of the treatment is the necessity of counteracting,

as far as possible, the tendency to retraction of the penis. The sulcus at the root of the penis must, as far as possible, be kept open by means of strips of lint, and the two granulating surfaces prevented from adhering to one another. It is at the root of the penis that skin-grafting is most essential and, at the same time, most difficult of fruition.

The latter part of the healing process is extremely tedious, and twelve weeks usually elapse before the patient leaves hospital.

Result of operation.

When the parasite is situated in the distal lymphatics of the scrotum, the success of the operation is complete; and the patient is not only freed from what is at one and the same time a hideous deformity, and a source of very great inconvenience; but he moreover loses entirely the liability to attacks of inflammation and fever. When, however, the disease is the result of obstruction situated high up in the lymphatic system, or is secondary to obstruction of the lymphatics of either or both the lower limbs, the operation does not affect the original source of the disease; and, although the scrotum remains free from further disorder, the damage to other portions of the lymphatic system will continue to em-

barrass the well being of the patient.